# The Changing Structure of Decision Support Systems Research: An Empirical Investigation through Author Cocitation Mapping

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## Abstract

*This paper extends earlier benchmark study(Eom 1995) which examined the intellectual structure, major themes, and reference disciplines of decision support systems (DSS) over the last two decades (1960-1990). Factor analysis of an author cocitation matrix over the period of 1990 through 1999 extracted 10 factors, representing six major areas of DSS research: group support systems, DSS design, model management, implementation, and multiple criteria decision support systems and five contributing disciplines: cognitive science, computer supported cooperative work, multiple criteria decision making, organizational science, and social psychology. We have highlighted several notable trends and developments in the DSS research areas over the 1990s.*

**Keywords**

The intellectual structure, reference disciplines, group support systems, DSS design, model management, implementation, and multiple criteria decision support systems

## 1. INTRODUCTION

Earlier studies documented the intellectual development of the decision support systems (DSS) area over the last two decades (1969-1990) in terms of two of the three main needs defined by Keen (1980)-- reference disciplines and a cumulative tradition. Eom (1995 p. 517) concluded that "After 20 years of research, the DSS literature does not exhibit an overall DSS research paradigm. Nonetheless, this study convinces the author that DSS is in the active process of solidifying its domain and demarcating its reference disciplines." This paper assesses the ongoing changes in the intellectual development and structure of DSS research, using multivariate analysis of an author cocitation matrix over the period of 1990 through 1999. This study aims at identifying the intellectual structure, reference disciplines, and major themes in DSS research over the past ten years (1990-1999) with a particular emphasis on contrasting the structural changes in the intellectual structures in the DSS area over the period of 1969 through 1990 and the period of 1990 through 1999.

## 2. DATA AND RESEARCH METHORD

The data for this study were gathered from a total of 984 articles in the DSS area over the past ten years (1990-1999), based on the criteria described in our earlier study. The number of citing articles can be an indicator of vitality of the DSS area. During the past 10 years, DSS researchers have published 984 articles at an average rate of 98.4 articles per year, while the previous two decades (1969-1990) had published a total of 632 articles at an average rate of 31.6 articles per year.

The raw cocitation matrix of 171 authors is analyzed by the factor analysis program of SAS (statistical analysis systems) to ascertain the underlying structure of DSS research subspecialties. Principal component analysis (varimax rotation) with the latent root criterion (eigenvalue 1 criterion) is applied to obtain the initial solution of 15 factors (see Table 1). The scree tail test indicates that only the first twelve factors should be qualified. For further details of author cocitation analysis including the statistical method used, readers are referred to Eom (2003).

## 3. RESULTS

Based on careful examinations and interpretation of these outputs, ten factors resulted, as shown in Appendix 1. The ten extracted factors account for 84.11 percent of the total variances of the data set. Factor analysis extracted ten factors consisting of six major areas of DSS research (group support systems, design, model management, user interface/implementation, evaluation, and multiple criteria decision support systems) and five contributing disciplines (cognitive science, computer supported cooperative works, multiple criteria decision making, organization science, and social psychology). Factor 4 seems to represent both the user interface and implementation factors. Factor 8 also includes authors in multiple criteria decision making (MCDM) and multiple criteria decision support systems (MCDSS). Through the comparison of the previous studies and this study, we identified that the DSS area has undergone profound structural changes in the intellectual structure over the past ten years (1990-1999). DSS research areas and reference disciplines can be categorized into four different groups -- steady, strengthening, emerging, dying, and slowly growing areas. The steady areas include model management which have appeared in the previous study (1995) and this study. In the reference discipline areas, organizational science and multiple criteria decision making have been consistently influenced to the development of DSS research subspecialties over the past 30 years (1969-1999). The GSS area has been strengthened significantly since 1990s. *The emerging areas* are represented by design, implementation, MCDSS, and evaluation in the DSS research area and cognitive science, CSCW, social psychology in the contributing discipline. *The dying area* includes two DSS research subfields (foundation and individual differences) that appeared to be no longer active. Group support systems (GSS) research has been strengthened and model management research has been a continuously central research theme. Organization science has been a steady field of DSS contributing discipline.

### 3.1Group Support Systems

Factor 1 appears to define ***group support systems (GSS)***. Undoubtedly GSS have now become the mainstream research field by many different measures. This investigation period include 171 scholars as markers of the DSS intellectual space. Seventy-nine of these scholars (46%) were clustered into factor 1. In terms of percent of variance, the percent of variance of the GSS factor (36.6%) tells the relative importance of the GSS factor.

Appendix A lists 79 authors under Factor 1. The unique contributions of ACA analysis is the reconstruction of bird's eye view of each subfield thorough the identification of a group of influential and responsible DSS researchers who represent major forces that have charted and perhaps will chart the future directions for DSS research and redirect DSS research efforts toward a common paradigm. "Any study of paradigm-directed or of paradigm-shattering research must begin by locating the responsible group or groups" (Kuhn 1970, p.242). Some of the important recent developments in this area can be summarized as follows.

3.1.1 GSS Tool Developments

There have been continuing developments and enhancements of GSS tools to support and augment the existing group DSS and electronic meeting systems such as an idea consolidator (Aiken et al. 1992), an optimization-based group decision tool for combining subjective estimates and extracting the underlying knowledge of group members (Singh et al. 1992), a hypertext and computer-mediated communication systems (Turoff et al. 1993), a group software for modeling and analyzing business process re-engineering (Dennis et al. 1993-1994), an interactive videodisc-based GDSS for directing the pattern, timing, and contents in group decision making (Reisman et al. 1992).

3.1.2 GSS Application Developments

A wide range of GSS/electronic meeting systems/decision conferencing system applications has been reported to support/facilitate a wide rage of decisions (Eom et al. 1998).

3.1.2. Empirical/laboratory experimental studies

A number of empirical/laboratory experimental studies have been conducted to investigate the effects of a variable on the quality of group decisions, level of agreement, subjective satisfaction, etc. For a comprehensive reviews of GSS field studies, See (Fjermestad et al. 1998-1999), which presents a descriptive evaluation of 54 case and field studies from 79 published papers spanning two decades of group support systems research.

3.1.3 Integrated GSS with other technologies

GSS is being integrated with other technologies such as expert systems and case-based reasoning, etc. A prototype system that embedded expert systems into GDSS is developed to make a GSS a more user-friendly and powerful tool for group support by capturing the scarce expertise of human facilitators GSS session management knowledge (Aiken et al. 1991). The distributed artificial intelligence approach for designing and developing group problem solving systems is being investigated to coordinate organizational activities in a distributed environment through the development of prototype systems comprising a network of expert systems (Shaw et al. 1993).

### 3.2 Design of DSS

Factor 2 seems to represent Design of DSS. Over the past 10-year period (1990-1999), design of DSS has emerged as a DSS research subfield. Traditional assumptions in the DSS area are being challenged. One of them includes the role of cognitive styles in the DSS design. A significant development in the 1990s is the demise of Individual differences (cognitive style) research as a basis of DSS design in the DSS literature. After over a decade of cognitive styles and individual difference research, Huber (Huber 1983, p.567) concluded that "the currently available literature on cognitive styles is an unsatisfactory basis for deriving operational guidelines for MIS and DSS designs" and "Further cognitive style research is unlikely to lead to operational guidelines for MIS and DSS designs." A number of empirical studies conducted to test the existing DSS design frameworks/theory. Igbaria and Guimaraes (1994) empirically tested the outcomes of user involvement in the DSS development to establish the positive relationship between user involvement and several measures of system success such as DSS usages, user overall satisfaction with the DSS, and user perceived DSS benefits. A contingency model of DSS design methodology is developed by Arinze (1991) to help DSS developers select an appropriate methodology out of several methodologies of data-driven, process driven (Keen et al. 1978; Sprague et al. 1982), decision-driven (Stabell 1983), and systemic paradigms (Ariav et al. 1985).

### 3.3 Model Management

Factor 3 appears to represent Model management Since 1975, model management has been researched to encompass several central topics such as model base structure and representation, model base processing, and application of artificial intelligence to model integration, construction, and interpretation

3.3.1 Structured Modeling

In the model structure and representation area, the structured modeling approach by Geoffrion (1987) has advanced the model representation area of model management, which is an extension of the entity-relationship data model and a necessary step for advancing to the next stage of model management (model manipulation). According to Geoffrion, structured modeling is a systematic way of thinking about models and their implementations to overcome perceived shortcomings of modeling systems available in the 1980s. It is based on the idea that every model can be viewed as a collection of distinct elements, each of which has a definition that is either primitive or based on the definition of other elements in the model.

Dolk and Konsynski (Dolk et al. 1984; Konsynski et al. 1982) developed the model abstraction structure for representing models as a feasible basis for developing model management systems. Dolk (1993) attempts to connect both artificial intelligence and database management to evolve a theory of model management via model integration relying heavily upon the relational database theory. In the model processing area, Blanning (1982) investigated important issues in the design of relational model bases and presented a framework for the development of a relational algebra for the specification of join implementation in model bases.

3.3.2 New Approaches to Model Management

During the 1990s, there has been a variety of new approaches to manage models as organizational resources. Some of notable approaches include the development of graph-based modeling (Jones 1995), object-oriented approach (Muhanna et al. 1994), mdeling by analogy (analogical modeling) and cased-based learning (Liang et al. 1993), modeling by example (Angehrn 1991), active modeling systems (Dolk et al. 1991), knowledge-based model construction (Murphy et al. 1986).

Model integration is another active line of DSS research. There has been several new approaches to model integration such as integrating simulation modeling and inductive learning in an adaptive decision support system (Piramuthu et al. 1993), Object-oriented model integration (Dempster et al. 1991), model integration using metagraph (Basu et al. 1994 p. 195).

### 3.4 User-Interface/Implementation

Factor 4, User Interface/Implementation, is a new factor that emerged in this study. Design, implementation, and evaluation of information systems are an integrated and inseparable process, as shown by several studies, which reported the identification of DSS implementation success factors and the linkage between those factors and DSS effectiveness (Ramamurthy et al. 1992). Because of the inseparable nature of system design and implementation, factor 4 includes authors in these two areas. DSS implementation research over the past three decades (1970-1999) has been primarily concerned with investigating the relationship between various factors (user related and other factors) and implementation success. User-related factors include cognitive style (the characteristic ways individuals process and utilize information to solve problems), personality (the cognitive structures maintained by individuals to facilitate adjustment to events and situations), demographics (age, sex, and education), and user-situation variables (training, experiences, and user involvement) (Alavi et al. 1992), (Zmud 1979).

DSS implementation research aims at systematically identifying factors which will influence the implementation success of DSS so that those critical factors can be managed effectively to increase the successful implementation of DSS in organizations. Several studies reported the identification of DSS implementation success factors and the linkage between those factors and DSS effectiveness (Alavi et al. 1992; Igbaria et al. 1994; Ramamurthy et al. 1992). Like so many empirical studies in other fields, no direct comparison of these studies are possible due to different methodologies, samples, etc. For example, Ramurthy, King, and Prekumar (1992 p.469) concluded that "user's domain-related expertise, systems experience, gender, intelligence, and cognitive style have important influence on one or more dimensions of DSS effectiveness. However, their relative importance vary with the outcome measure of choice." An empirical study of Igbaria and Guimaraes (1994) strongly confirmed that user involvement and DSS friendliness are critical DSS success factors.

Despite conflicting and confusing findings in the area of implementation research, a systematic integration and assessment of a large set of DSS implementation research seems to suggest that DSS implementation research has been accumulating its research findings. The review of DSS implementation research over the period of 1991 through 1997 led us to conclude the following:

1. Over the past three decades, MIS/DSS researchers have identified numerous factors affecting MIS/DSS. They are classified into external environments (environmental characteristics), organizational environment (characteristics), task environment (characteristics), other factors including human factors (user's personal characteristics and MIS staff characteristics) and non-human factors (MIS policies). Of these, the majority of implementation researchers focus on the user related factors (cognitive styles, personality, demographics, user-situational variables).
2. Based on the meta analysis of prior implementation research, we are further readjusting the focus of DSS implementation research on the user-situational variables. The user-situational variables (involvement, training and experience) are more important than cognitive styles and personality and the DSS implementation success rate can be improved by as much as 30 percent by manipulating user-situational variables (Alavi and Joachimsthaler 1992). Further their study concluded that "future research should be directed toward developing causal models of DSS implementation that weave these key factors together in a form that makes their interrelationship explicit."

### 3.5 DSS Evaluation

Decision support systems management consists of an ongoing, inseparable process of designing, implementing, and evaluating DSS. Decision support systems are to assist managers in their decision making processes to improve the effectiveness of decision making rather than its efficiency. Evaluation of DSS is concerned with analysing costs and benefits of decision support systems before and after DSS development and implementation. The unique nature of DSS evaluation is that although some DSS provides substantial cost saving and profit increase, measurements of benefits of DSS have been a difficult problem, due to the fact that quantification of the positive impacts of improved decision process is difficult (Keen et al. 1978).

Evaluating DSS is concerned with determining the value of DSS. The value of DSS can be measured by a smorgasbord of eight methodologies: (1) decision outputs; (2) changes in the decision process; (3) changes in managers' concepts of the decision situation; (4) procedural changes; (5) classical cost/benefit analysis; (6) service measures; (7)managers' assessment of the system's value; and (8) anecdotal evidence (Keen et al. 1978).

Aldag and Power(1986) reviewed a number of prior research. Most of these papers are concerned with the use of multiple attribute decision making model based decision aids to improve the effectiveness of decision making. An interactive heuristic program was used to solve a case problem by two groups of students. The result of the Aldag and Power study detected no significant differences in performances although user attitudes toward the computer-based decision aid were favourable and user gained more decision confidence. Their study suggested that user affect should not be used as a proxy for decision quality and DSS must be adopted with caution in that if such decision aids result in positive user affect and heightened decision confidence without corresponding improvements in decision quality, DSS may be dysfunctional.

Sharda and others (1988) conducted an experimental investigation using an executive decision making game played by two sections of a business strategy course to find out that the groups with DSS made significantly more effective decisions and examined more alternatives and exhibited a higher confidence level in their decisions than their non-DSS counterparts.

### 3.6 Reference Disciplines of DSS Research

Due to the space limitations, we will not discuss the DSS reference disciplines uncovered in this study – cognitive science, computer-supported cooperative network, multiple criteria decision making, organizational science, and social psychology.

## 4. CONCLUSION

This study investigates an ongoing change in the intellectual structure of DSS research fields through a comparison of the bibliometrical study between the first two decades of DSS research (1969-1990) and the recent ten years (1990-1999). We are now in a better position to understand the dynamic dimension of the intellectual structure of DSS research. This study identified a dynamic dimension of DSS research areas to account for the ongoing changes in its "disciplinary matrix" -- the four emerging areas (Implementation, Design, and Cognitive science); continuously growing areas (GDSS, Model management, MCDM, and Organization science); and dying areas (Individual difference and Foundations).

In a nutshell, the factors in this study appear to reflect the maturing stages of DSS research, aiming at providing a macro view of DSS research literature with a goal of providing a basis for developing coherent DSS theories to sort out a confusing body of a variety of DSS literature. The changes in the intellectual structures in decision support systems have been profound over the 1990s. Focus of DSS research appears to be shifting from the study of DSS components (data, model, individual differences of decision makers) during the periods of 1970 through 1990 to the design, implementation, and user-interface management (which have not been shown to be substantive DSS research subspecialties in the previous research), to provide useful guiding principles for practitioners in the integrated processes of design, implementation, and evaluation of decision support systems. The model management and group decision support systems areas have been continuously researched over the two periods of investigation. In the area of model management, much progress has been made in the sub-areas of model representation, model base processing, model integration, and the application of artificial intelligence to model management.

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# APPENDIX 1

**Table 1. Factor Structure Correlations (factor loading at .40 or higher; rotation method: Oblique; number of factors=10)**

| Factor 1 GSS | | Factor 2 Design | | Factor 3 Model Management | | Factor 4 User Interface/Impl. | |
|---|---|---|---|---|---|---|---|
| DENNIS | 0.96 | SPRAGUE | 0.95 | GEOFFRION | 0.98 | IVES | 0.94 |
| JESSUP | 0.96 | TURBAN | 0.92 | KRISHNAN | 0.96 | ZMUD | 0.91 |
| VALACICH | 0.96 | KEEN | 0.90 | DOLK | 0.95 | BAROUDI | 0.90 |
| NUNAMAKER | 0.96 | CARLSONED | 0.90 | GREENBERG | 0.94 | LUCAS | 0.89 |
| GALLUPE | 0.96 | SCOTT MORTON | 0.89 | MUHANNA | 0.94 | OLSONMH | 0.89 |
| GEORGE | 0.95 | WATSONHJ | 0.86 | MURPHYFH | 0.93 | ROBEY | 0.87 |
| POOLE | 0.95 | ELAM | 0.86 | JONESCV | 0.92 | SWANSON | 0.87 |
| VOGEL | 0.95 | HOLSAPPLE | 0.86 | PICK | 0.91 | SANDERSGL | 0.85 |
| MCGRATHJE | 0.95 | WHINSTON | 0.86 | STOHR | 0.91 | COURTNEY | 0.82 |
| DESANCTIS | 0.94 | HENDERSONJ | 0.86 | LIANG | 0.90 | KINGWR | 0.81 |
| CONNOLLY | 0.94 | ALTER | 0.85 | BINBASIOGLU | 0.89 | ROCKART | 0.81 |
| WATSONRT | 0.94 | BENNETT | 0.84 | FOURER | 0.88 | ALAVI | 0.78 |
| NORTHCRAFT | 0.91 | BONCZEK | 0.83 | MEERAUS | 0.87 | GINZBERG | 0.70 |
| HILTZ | 0.91 | ARIAV | 0.82 | BASU | 0.87 | DAVISFD | 0.68 |
| TUROFF | 0.91 | GORRY | 0.82 | MA | 0.87 | DEXTER | 0.68 |
| BOSTROM | 0.91 | GINZBERG | 0.81 | KIMBROUGH | 0.86 | MCLEANER | 0.67 |
| KRAEMER | 0.91 | EOM | 0.79 | BHARGAVA | 0.86 | BENBASAT | 0.66 |
| ZIGURS | 0.91 | LEESM | 0.78 | KERNIGHAN | 0.86 | KEEN | 0.66 |
| STEINERID | 0.91 | WATKINS | 0.77 | BLANNING | 0.84 | WATSONHJ | 0.66 |
| TANSIK | 0.91 | SIMONHA | 0.76 | KENDRICK | 0.83 | ALDAG | 0.62 |
| SHAWME | 0.90 | HURT | 0.75 | DUTTA | 0.79 | POWERDJ | 0.61 |
| HACKMAN | 0.90 | SHAWMJ | 0.69 | SHAWMJ | 0.70 | DELONG | 0.61 |
| SEIBOLD | 0.90 | KOTTEMANN | 0.68 | HOLSAPPLE | 0.63 | SIMONHA | 0.59 |
| SAMBAMURTHY | 0.90 | BLANNING | 0.67 | WHINSTON | 0.63 | REMUS | 0.58 |
| GALEGHER | 0.90 | DUTTA | 0.67 | JARKE | 0.62 | MINTZBERG | 0.58 |
| MCLEODPL | 0.89 | COURTNEY | 0.65 | BONCZEK | 0.62 | HUBER | 0.56 |
| PINSONNEAULT | 0.89 | BARIFF | 0.64 | ELAM | 0.58 | BARIFF | 0.56 |
| KIESLER | 0.89 | MARCHJG | 0.62 | KOTTEMANN | 0.54 | SCOTT MORTON | 0.55 |
| RAOVS | 0.88 | LIANG | 0.61 | HENDERSONJ | 0.53 | MARCHJG | 0.54 |
| LIMLH | 0.87 | ZIONTS | 0.60 | | | SILVERMS | 0.54 |
| WYNNEBE | 0.87 | WALLENIUS | 0.60 | | | VESSEY | 0.52 |
| HOLLINGSHEAD | 0.87 | NEWELL | 0.60 | | | ALTER | 0.52 |
| COOPERWH | 0.87 | ALAVI | 0.59 | | | TODD | 0.52 |
| RAMAN | 0.87 | STOHR | 0.58 | | | MCDONNELLJC | 0.49 |
| CHIDAMBARAM | 0.87 | SILVERMS | 0.58 | | | BARSH | 0.49 |
| JANIS | 0.87 | KINGWR | 0.56 | | | MASONRO | 0.48 |
| WILLIAMSE | 0.87 | JARKE | 0.56 | | | JARVENPAA | 0.48 |
| BASTIANUTTI | 0.86 | BASU | 0.54 | | | GORRY | 0.47 |
| ANSON | 0.86 | DOLK | 0.53 | | | DICKSON | 0.46 |
| DUBROVSKY | 0.86 | ROCKART | 0.52 | | | SPRAGUE | 0.46 |
| JOHANSEN | 0.86 | REMUS | 0.52 | | | SHARDA | 0.46 |
| DICKSON | 0.86 | SANDERSGL | 0.51 | | | ARIAV | 0.46 |
| HOLMES | 0.86 | JONESCV | 0.51 | | | HENDERSONJ | 0.45 |
| MCGUIRETW | 0.85 | ZMUD | 0.50 | | | NEWELL | 0.45 |
| SIEGELJ | 0.85 | JELASSI | 0.48 | | | TURBAN | 0.43 |
| DAFT | 0.85 | SWANSON | 0.47 | | | HURT | 0.42 |
| MARTZ | 0.85 | MINTZBERG | 0.45 | | | WEICK | 0.40 |
| JOHNSONK | 0.85 | MALONE | 0.43 | | | | |
| OSBORNAF | 0.85 | GEOFFRION | 0.43 | | | | |
| MCGOFF | 0.84 | HOGARTH | 0.42 | | | | |
| DELBECQ | 0.83 | ROBEY | 0.41 | | | | |
| LEWISLF | 0.83 | LUCAS | 0.41 | | | | |
| SPROULL | 0.83 | SHARDA | 0.41 | | | | |
| HEMINGER | 0.83 | ALDAG | 0.41 | | | | |
| LENGEL | 0.83 | KONSYNSKI | 0.41 | | | | |
| VAN DE VEN | 0.82 | RAIFFA | 0.40 | | | | |
| GRAYP | 0.82 | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| DIEHL | 0.82 | | | | | | |
| GROHOWSKI | 0.82 | | | | | | |
| ACKOFF | 0.82 | | | | | | |
| STROEBE | 0.82 | | | | | | |
| BEAUCLAIR | 0.82 | | | | | | |
| JARVENPAA | 0.81 | | | | | | |
| KINGJL | 0.81 | | | | | | |
| ROHRBAUGH | 0.80 | | | | | | |
| APPLEGATE | 0.80 | | | | | | |
| JOHNSTONSC | 0.79 | | | | | | |
| HUBER | 0.79 | | | | | | |
| STEEB | 0.79 | | | | | | |
| GUSTAFSON | 0.78 | | | | | | |
| WEICK | 0.74 | | | | | | |
| KONSYNSKI | 0.71 | | | | | | |
| BUI | 0.67 | | | | | | |
| MALONE | 0.66 | | | | | | |
| FOSTER | 0.65 | | | | | | |
| MCLEANER | 0.64 | | | | | | |
| BENBASAT | 0.63 | | | | | | |
| SUCHMAN | 0.61 | | | | | | |
| KAHNK | 0.60 | | | | | | |
| LANNING | 0.60 | | | | | | |
| MITROFF | 0.60 | | | | | | |
| MASONRO | 0.59 | | | | | | |
| BOBROW | 0.59 | | | | | | |
| DAVISFD | 0.59 | | | | | | |
| STEFIK | 0.54 | | | | | | |
| JELASSI | 0.50 | | | | | | |
| MINTZBERG | 0.50 | | | | | | |
| ALAVI | 0.45 | | | | | | |
| SHAKUN | 0.44 | | | | | | |
| Variance | 63 | | 29 | | 24 | | 25 |
| % of Variance | 37% | | 17% | | 14% | | 15% |

| **Factor 5 Cognitive Science** | | **Factor 6 CSCW** | | **Factor 7 Evaluation** | | **Factor 8 MCDM/MCDSS** | |
|---|---|---|---|---|---|---|---|
| PAYNEJW | 0.93 | STEFIK | 0.91 | MCDONNELL | 0.91 | RAIFFA | 0.84 |
| HOGARTH | 0.90 | SUCHMAN | 0.90 | BARSH | 0.90 | WALLENIUS | 0.84 |
| EINHORN | 0.90 | KAHNK | 0.90 | SHARDA | 0.89 | KEENEY | 0.83 |
| TVERSKY | 0.88 | BOBROW | 0.90 | POWERDJ | 0.84 | ZIONTS | 0.82 |
| SLOVIC | 0.88 | FOSTER | 0.89 | ALDAG | 0.84 | JELASSI | 0.82 |
| KAHNEMAN | 0.86 | LANNING | 0.89 | BARIFF | 0.75 | SHAKUN | 0.80 |
| TODD | 0.84 | MALONE | 0.71 | KINGWR | 0.74 | JARKE | 0.75 |
| VESSEY | 0.80 | KINGJL | 0.70 | DEXTER | 0.73 | BUI | 0.73 |
| NEWELL | 0.79 | APPLEGATE | 0.68 | REMUS | 0.70 | KONSYNSKI | 0.53 |
| REMUS | 0.75 | KONSYNSKI | 0.68 | BENBASAT | 0.60 | HUBER | 0.53 |
| SILVERMS | 0.75 | BEAUCLAIR | 0.67 | COURTNEY | 0.60 | LEESM | 0.50 |
| SIMONHA | 0.74 | GRAYP | 0.67 | LUCAS | 0.60 | EOM | 0.49 |
| DEXTER | 0.71 | STEEB | 0.66 | VESSEY | 0.55 | BEAUCLAIR | 0.48 |
| BENBASAT | 0.69 | ROHRBAUGH | 0.65 | ZMUD | 0.54 | KINGJL | 0.47 |
| MARCHJG | 0.67 | BUI | 0.65 | TODD | 0.54 | HENDERSONJ | 0.46 |
| BARIFF | 0.61 | JOHNSTONSC | 0.64 | KEEN | 0.52 | MASONRO | 0.45 |
| LUCAS | 0.54 | LEWISLF | 0.62 | GINZBERG | 0.51 | MALONE | 0.45 |
| COURTNEY | 0.49 | HUBER | 0.61 | KOTTEMANN | 0.50 | HURT | 0.44 |
| DAVISFD | 0.49 | JELASSI | 0.61 | ROBEY | 0.50 | APPLEGATE | 0.44 |
| KOTTEMANN | 0.49 | JOHANSEN | 0.60 | HURT | 0.50 | ROHRBAUGH | 0.44 |
| ZMUD | 0.48 | KRAEMER | 0.58 | ALAVI | 0.49 | STEEB | 0.44 |
| ALDAG | 0.48 | JARKE | 0.54 | SWANSON | 0.49 | MITROFF | 0.44 |
| POWERDJ | 0.48 | RAOVS | 0.53 | HUBER | 0.48 | GRAYP | 0.43 |
| KEEN | 0.48 | NUNAMAKER | 0.53 | SANDERSGL | 0.47 | BENNETT | 0.43 |
| KINGWR | 0.47 | DESANCTIS | 0.53 | SIMONHA | 0.47 | JOHNSTONSC | 0.43 |
| ROBEY | 0.46 | TUROFF | 0.53 | ALTER | 0.47 | ELAM | 0.42 |
| MINTZBERG | 0.44 | ACKOFF | 0.52 | SILVERMS | 0.46 | KEEN | 0.41 |
| GINZBERG | 0.44 | HILTZ | 0.52 | JARVENPAA | 0.45 | KRAEMER | 0.40 |
| SCOTT MORTON | 0.44 | GALLUPE | 0.51 | IVES | 0.44 | GUSTAFSON | 0.40 |
| ARIAV | 0.43 | DICKSON | 0.51 | DICKSON | 0.43 | DESANCTIS | 0.39 |
| HURT | 0.43 | MARTZ | 0.51 | HENDERSONJ | 0.43 | | |
| RAIFFA | 0.41 | VOGEL | 0.51 | SCOTT MORTON | 0.42 | | |
| SHARDA | 0.40 | ZIGURS | 0.50 | SPRAGUE | 0.41 | | |
| | | GUSTAFSON | 0.50 | BAROUDI | 0.41 | | |
| | | JARVENPAA | 0.50 | ELAM | 0.41 | | |
| | | MCGOFF | 0.50 | PAYNEJW | 0.40 | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | HEMINGER | 0.49 | | | | |
| | | GROHOWSKI | 0.49 | | | | |
| | | WATSONRT | 0.48 | | | | |
| | | POOLE | 0.47 | | | | |
| | | GEORGE | 0.46 | | | | |
| | | JESSUP | 0.46 | | | | |
| | | DENNIS | 0.45 | | | | |
| | | DELBECQ | 0.44 | | | | |
| | | VAN DE VEN | 0.44 | | | | |
| | | SHAKUN | 0.43 | | | | |
| | | MASONRO | 0.43 | | | | |
| | | MCGUIRETW | 0.42 | | | | |
| | | PINSONNEAULT | 0.42 | | | | |
| | | SIEGELJ | 0.42 | | | | |
| | | KIESLER | 0.42 | | | | |
| | | MITROFF | 0.42 | | | | |
| | | BENNETT | 0.42 | | | | |
| Variance | 18 | | 24 | | 17 | | 18 |
| % of Variance | 11% | | 14% | | 10% | | 10% |

| **Factor 9** **Organization Science** | | **Factor 10** **Social Psychology** | |
|---|---|---|---|
| THEORET | 0.89 | DUBROVSKY | 0.41 |
| RAISINGHANI | 0.88 | SIEGELJ | 0.41 |
| MINTZBERG | 0.84 | MCGUIRETW | 0.41 |
| MITROFF | 0.74 | KIESLER | 0.40 |
| MASONRO | 0.67 | | |
| SIMONHA | 0.57 | | |
| MARCHJG | 0.55 | | |
| WEICK | 0.52 | | |
| NEWELL | 0.49 | | |
| COURTNEY | 0.44 | | |
| HUBER | 0.42 | | |
| JANIS | 0.42 | | |
| OSBORNAF | 0.41 | | |
| KONSYNSKI | 0.41 | | |
| SILVERMS | 0.40 | | |
| Variance | 14 | | 3 |
| % of Variance | 8% | | 2% |

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