Information Systems Management Issues: Controlling Proliferation

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Abstract

Information systems management issues continue to be a popular research topic. Understanding such issues is important in the allocation of scare resources. However, issues shift over time, are not often clearly delineated, and depend on respondent vocabularies. These problems have lead to an ever increasing list of issues that can blur understanding as well as make survey design a larger challenge. This study examines perceptions of issue importance to develop a preliminary definition of issue categories. With further refinement, the issue categories can mitigate difficulties of vocabulary, lessen technology bias, and allow for a clearer descriptive framework.

Introduction

Information systems management (ISM) issues are the focus of a number of studies over the last fifteen years (Brancheau and Wetherbe, 1987; Dickson, *et al.*, 1984; Caudle, Gorr and Newcomer, 1991; Douglass, 1992). ISM issues are important because they help an organization focus its scarce internal funds for development and maintenance of information systems. Questions related to funding of new information systems (IS) development, maintenance of current systems, the information resources that are critical in the current business environment, and how competitors are spending their IS budgets can be partially answered by studying the perceived importance of the issues (Moynihan, 1990).

Difficulties arise in studying ISM issues from several standpoints. Trends indicate that issue importance slowly evolves over time (Niederman *et al.*, 1991). There is also an indication that the issues vary by industry and whether the respondents are directly or indirectly affiliated with the IS function (Leitheiser, 1992). Issues do not appear in repeated studies as they migrate off the list or are "newer and hotter" topics that did not exist at the time of prior studies. These problems serve to increase the number of issues that must be investigated in a study, possibly confounding research projects and adding to the cognitive burden on the subjects.

Still other problems in developing a list of issues involve the overlapping of issues. Some are not clearly distinguishable from others or are tied to similar organizational functions. Not surprisingly, issues closely linked often wind up being ranked near the same level in many of the studies cited. Terminologies are often vague and do not have shared meaning with all audiences (Osgood, *et al.*, 1957). These difficulties are compounded by a proliferation of issues.

Increasing numbers of issues are also a complication to managers attempting to use issues in the allocation of resources. Attention to ISM issues frequently published by MIS researchers would lead to an insurmountable number of topics requiring attention. Yet studies continue to appear in the literature with little concern for issues in previous studies or any clear definition of the relationship to prior studies. Each reference on IS issues in this paper contains numerous citations to previous works, indicating a large volume of work on issue research. Yet only Niederman, *et al* (1991) appear to recognize the proliferation and present a complete reasoned categorization.

To control proliferation by categorization is well accepted as a sound practice. Decisions are often best viewed from a more broad based perspective than by burying a decision maker in details. Managers often do better by taking a more strategic view of issues than by being concerned with a rapidly evolving set of fine points. Pursuit of smaller issues can be detrimental to the organization (Economist, 1997). MIS developers have long acknowledged that top-down designs are more effective than the bottom-up variety (Gane and Sarson, 1979).

With these criticisms in mind, it may be best to examine the nature of the issue structure. Rather than expanding the list of issues, it may be best to identify common themes or perceptions of the issues, similar to categorization research common to social sciences (Bailey, 1994). The identification of issue categories may serve to clarify the issues picture, to determine if issues really change or if only the hot topics within the issues change, to determine if issues truly differ by groups of individuals or if vocabularies alter perceptions of the issues (Osgood *et al.*, 1957).

Two early studies recognized the problem and proposed cursory two-way categorizations. Brancheau and Wetherbe (1987) denote issues as being either management or technology related. Watson (1989) classifies ISM issues according to whether they are primarily planning or control related. Niederman, *et al.* (1991) use a four-way description based more on a reasoned approach. Their classification splits the issues into technology infrastructure (TI), internal IS effectiveness (IE), technology application (TA), and business relationship (BR) concerns external to IS. They find that BR issues are historically strongest with the other three categories gaining in importance. Their categorization, however, is based on subjective reasoning. In this paper we analytically explore a set of issue importance ratings to help determine categories of ISM issues using the insight of Niederman, *et al.* (1991) as a basis.

Methodology

Samples

The survey is limited geographically to a major economic region of the United States. The area's economic diversity includes automotive component manufacturing, the furniture industry, biodegradable products, financial services, and major retailing headquarters. These businesses serve the domestic and international marketplace. The region has exhibited above average growth in population and industrial base for many years.

The survey was completed by top managers, IS managers, and non-IS managers. These people all use information resources in their work. About 50 firms were identified and the questionnaire was then distributed to their IS managers and non-IS managers in person by the researchers. A total of 83 respondents completed the instrument for a 70% response rate. The distribution of the survey respondents by management level, company size and, industry is in Table 1. Nearly 50 percent of the respondents are from the manufacturing sector. This is similar to the industry distribution experienced in the survey by Niederman, *et al.* (1991).

Instrument

The questionnaire used in the study is adopted from Dickson, *et al.*'s (1984), Niederman, *et al.*'s (1991), and Caudle, *et al.*'s (1991) studies. Issues that the studies found to be overlapping were not used. Duplicates were con-

Table 1
Distribution of Survey Respondents by Management Level

Management Level	Number of Respondents	Percentage
Top Management	17	20%
IS Managers	40	48%
Non-IS Middle Mgrs	20	24%
Staff Professional	5	6%
No response	1	1%
Company Size (No. of Employees)		
1 to 250	17	20%
251 to 1000	32	38%
> 1000	30	36%
No response	4	5%
Industry Area		
Manufacturing	39	47%
Service	41	49%
No response	3	4%

solidated. Thirty-five issues remained and are shown in appendix A. The survey required respondents to rank the importance of the 35 ISM issues on a five point Likert scale using the following qualitative judgment and corresponding values: 1 = not important; 2 = somewhat important; 3 = important; 4 = very important; and 5 = extremely important. Additional questions at the end of the questionnaire had the respondent provide information on their organization (number of employees, type of industry) and their position in the firm. Table 2 shows the results of the overall rankings and summary rankings by industry classification. These are very similar to previous studies (Niederman, et al., 1991).

Findings Regarding ISM issues

Before any categorization, testing is done to determine if any of the subpopulations might have a relationship to the rankings of the issues. A MANOVA with the 35 issues' responses as dependent variables is run against each demographic variable in turn. Only industry is found to be significant at .05. Table 2 shows the industry rankings. There are certain differences in the rankings between the ser-vice and manufacturing subgroups. However, when a Spearman's Rank correlation is determined on the 35 issues between the two subgroups, a correlation of .90 is attained. This is a remarkably high degree of correlation and shows how examining only the top issues from among all issues can lead to faulty conclusions about population differences. A set of issue categories might help alleviate this and the other research problems mentioned in the introduction.

To find possible issue categories, the au-thors per-formed a factor analysis. The technique used is principal components analysis with varimax rotation. Using Lautenschlager's rule (Lautenschlager, 1989) for selection of the number of components to be retained, four components are found to have eigenvalues greater than chance, the same number proposed by Niederman, *et al.* (1991). Restricting to four components, Table 3 shows the categories as classified by the loadings. Classifications are made using a rule of thumb where an item is considered to belong to a class if it has a loading greater than .45 and all other loadings are less than .35 (Igbaria, Greenhaus and Parasuraman, 1991). Further research is still needed to refine these categories.

When the four categorizations are examined, one can see that two of the components are almost identical to the categorizations of Niederman, *et al.* (1991). The BR and TA categories are clearly components 2 and 1 respectively. IE and TI fit components 3 and 4 conceptually, but the assignment of the individual issues is different than might be expected from the earlier research. To maintain consistency, the

Table 2
Top 15 Issues

	Overall	Manufacturing	Service
1	2. Align IS with corporate goals	2. Align IS with corporate goals	2. Align IS with corporate goals
2	5. Competitive Information Systems	5. Competitive Information Systems	27. Integration of Technologies
3	27. Integration of Technologies	27. Integration of Technologies	5. Competitive Information Systems
4	24. Data Integrity	24. Data Integrity	24. Data Integrity
5	1. Educating Senior Managers	1. Educating Senior Managers	23. Data Security
6	4. IS Planning	4. IS Planning	28. End-user Computing
7	28. End-user Computing	28. End-user Computing	4. IS Planning
8	23. Data Security	10. Measuring IS effectiveness	6. Business Re-engineering
9	10. Measuring IS effectiveness	23. Data Security	1. Educating Senior Managers
10	6. Business Re-engineering	15. System Development and Implementation	10. Measuring IS effectiveness
11	9. Identification of Information Requirements	9. Identification of Information Requirements	9. Identification of Information Requirements
12	15. System Development and Implementation	26. Database administration	25. External data sources
13	21. Empower IS personnel	32. Microcomputer software management	21. Empower IS personnel
14	29. Office Automation	6. Business Re-engineering	29. Office Automation
15	20. Substitution of Technology for trained personnel	21. Empower IS personnel	35. Telecommunication technology

authors shall use the same designators to describe the components.

The issues grouped into the business relationship (BR) category closely match the intent of this category. The issues include educating senior managers, aligning IS with corporate goals, political influence, research and development, identification of IS requirements, measuring IS effectiveness, integration of technologies, end-user computing, and office automation. These issues are all peripheral to the central IS function within an organization and yet clearly affect the activities within the IS function.

Table 3
Factor Structure and Categorization of Issues

	Category	Factor 1	Factor 2	Factor 3	Factor 4
1	BR	-.07	-.75	-.13	.01
2	BR	.35	-.52	-.09	-.21
3	BR	.11	-.54	.10	.26
4		.28	-.24	.22	-.30
5		.29	-.13	.11	-.13
6	TA	.49	-.10	.01	-.04
7	BR	.29	-.45	.02	.20
8	TI	.06	-.23	-.09	.38
9	BR	-.13	-.70	.25	.12
10	BR	-.07	-.56	.08	-.13
11		.10	-.45	.13	.44
12	TI	.20	-.15	-.09	.70
13	TA	.64	.11	.24	.33
14	TA	.47	.03	.21	.33
15	TA	.57	.00	.04	.27
16	TI	.27	-.03	.32	.53
17	TI	.18	.06	.07	.62
18	IE	.34	-.29	.51	.02
19	TA	.63	-.16	.37	.10
20	TA	.68	-.04	.08	.11
21	IE	.32	.15	.63	.25
22		.42	.04	.51	.08
23	IE	-.04	-.13	.65	-.19
24	IE	-.07	-.03	.63	.05
25	IE	-.24	-.08	.45	.24
26	IE	.25	-.06	.50	.00
27	BR	.30	-.51	.30	-.01
28	BR	.27	-.45	.18	.12
29	BR	.22	-.50	-.10	.09
30	TA	.51	-.35	-.06	.11
31	TA	.57	-.14	-.19	.04
32		-.02	-.36	.42	.18
33	TI	-.14	-.07	.01	.70
34	IE	-.01	-.10	.61	-.07
35		.42	.18	.45	-.11

The technology application category includes issues that address the application of IS technology. Most of the issues in this category are a natural fit, including information system types (decision support, and expert systems) and development concerns (maintenance, application generators, and system development and implementation). One inconsistency is the inclusion of business re-engineering, which would more appropriately appear with the BR issues. However, business re-engineering is a newer approach and may suffer from definition problems for the respondents.

The internal effectiveness category (IE) groups issues associated with security, administration, and empowerment. These items are clearly associated with the smooth operations of the IS function in an organization. The inconsistency evident in this group is that certain personnel issues (#18; meeting microcomputer applications personnel needs) fell into this category while others (#19; meeting tele-communications personnel needs, #16; IS career design, and #17; meeting mainframe personnel needs) fell into other categories.

The inconsistency in classification of "personnel" may be a result of uncertainty in the placement of personnel issues on the part of the respondents. Table 3 shows that the personnel issues tended to load into more than one component. It may also be that the respondents tend to place the personnel issues with the functional area to which the personnel are assigned, rather than considering all personnel issues to be similar. This latter view is supported by selection research in the personnel field showing the

association of different traits with success in different job types (Ghiselli, 1966).

The final category is the technology infrastructure (TI) group. The issues included in this category are basically those related to mainframe systems (software development, computing, and personnel) and outsourcing. Both of these areas clearly impact the technology infrastructure of an organization.

Now that the categories are identified, what would be the result of prior analyses? Table 4 shows the unweighted mean scores of the issues' raw scores as classified by the component analysis. Business relations turn out to be the most important as expected. This matches every cited study. The technology infrastructure, technology applications, and internal effectiveness follow in that order. Perhaps even more interesting is that a repetition of the MANOVA analyses using the component scores as the dependent variables finds that no demographic variable has a relation to the responses. Thus, for this population, the issue categories have washed out the differences in the industry subgroups. This leads one to believe that previous results may be due more to statistical anomalies and vocabulary problems than to actual differences within and between sample populations.

Table 4
Averages and Ranks for Issue Categories

Category	Average	Rank
BR	3.78	1
TI	3.54	2
TA	3.27	3
IE	2.83	4

Managerial Implications

Previous studies in information management issues indicate that the importance of issues change over time and may vary within the population according to certain demographics. More recent research (Niederman *et al.*, 1991), however, examines the trend of issue importance by issue categories. Such an analysis permits a more viable view of the issue trends because vocabulary and time-dependent biases can be ameliorated. The study described in this paper analytically categorizes a number of ISM issues and finds that certain statistically supported claims that hold at the detailed issue level do not hold at the categorical level.

Managers may benefit from categories by placing issues into a broader perspective. The ability to begin examining problems from the top down is critical to the success of managers. Categories allow such a controlled perspective and can help reduce the time spent addressing issues that migrate in and out of current research agendas. Managers face enough change without concerning themselves over phantom issues or dedicating resources to hot topics that are already part of a strategic view of information system issues.

Implications for Future Research

Issue categories could also be very important in researching ISM issues in the future. Categories can (1) wash out differences in subpopulations that may exist only in vocabulary associated with background, permitting a truer examination of differences between subpopulations and add meaning to the magnitude of the scale differences; (2) help control the swelling numbers of "important" IRM issues; (3) dampen biases introduced by hot technology and fad methodology; (4) assist in the evaluation of the relative importance of technology applications; (5) provide insights about the dimensions of ISM issues and provide a framework for IS resource management; and (6) provide a clearer picture of IS development trends by finding common meanings implicit in varied verbiage.

Further work needs to go into refining the issue categories and identifying a set of issues that dependably identify the categories. The results of this study only serve to demonstrate that it is possible to develop issue categories and did find a relation to a system proposed by other researchers. Larger samples and clearer theoretical

definitions of the issues are needed for a confirmatory study.

In addition, once any theory is established, then a method for reliably classifying newly identified issues into the issue category framework must be developed. A meta analysis or studies on a compilation of previous data sets may be comprehensive enough to begin making headway on this latter topic.

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Appendix A: Issues Included on the Survey

1: Educating Senior Managers: Top management learn the role of IS.

2: Align IS with Corporate Goals: Developing approaches and frameworks that will enable IS to align information technology with organization's overall strategies, objectives, and planning.

3: Political Influence: New planning and budgeting procedures should be developed to reduce the impacts of short-run political priorities that can undercut comprehensive, long-term IS planning.

4: IS Planning : Improving IS strategic as well as short-run planning.

5: Competitive Information Systems: IS must be managed to contribute to a firm's competitive advantages, not just for operational efficiency or decision support.

6: Business Re-Engineering: Current business process must be rethought and redesigned. In some cases, the process may need to be eliminated altogether.

7: Research and Development: Organizations should devote more resources to monitor and evaluate technological development for organizational needs.

8: Outsourcing: Strategy and policies are needed for organization considering IS outsourcing/downsizing where they want to go and how they are going to get there.

9: Identification of Information Requirements: Organizations should develop systematic processes to identify and prioritize information requirements.

10: Measuring IS Effectiveness: Organizations should develop better measures and estimation methods to show the true costs of information and evaluate the benefits of the current and/or proposed IS.

11: Procurement and Service Delivery: Organizations should modify procurement and service delivery procedures to expedite the delivery of information services, hardware, and/or technical assistance.

12: Mainframe Software Development: Mainframe applications software should be developed more quickly and with consistently higher quality.

13: Application Generators: IS must increasingly use application generators (i.e. CASE) and fourth generation languages in place of third generation languages to increase productivity.

14: Software Maintenance: IS managers need to find ways of improving productivity in software maintenance.

15: System Development and Implementation: IS managers must find ways to successful development and implement new IS in organizations within a time period.

16: IS Career Design: Organizations need to design different career paths (goals) for IS personnel.

17: Meeting Mainframe Personnel Needs: Continued personnel shortage will increase the need for resources to recruit, retain and retrain mainframe personnel.

18: Meeting Microcomputer Applications Personnel Needs: Continued personnel shortage will increase the need for resources to recruit, retain and retrain personnel in microcomputer software and applications positions.

19: Meeting Telecommunications Personnel Needs: Continued personnel shortage will increase the need for resources to recruit, retain, and retain personnel in telecommunication personnel.

20: Substitution of Technology for Trained Personnel: Continued personnel shortages will require IS to depend more heavily on application generators, database management systems, end-user computing and so o, to meet information need.

21: Empower IS personnel: In a time of "downsizing" or "right-sizing," it is necessary to focus on creating fulfilling careers for the talented members of the IS staff you want to keep.

22: Distributed Data Processing: Policies are needed that support the advantages of distributed data processing while maintaining the integrity of central information systems.

23: Data Security: Organizations should balance data security and data availability through appropriate protocol and access controls.

24: Data Integrity: IS must devote additional; resources to the accuracy, timeliness and adequacy of data provided to users.

25: External Data Sources: Mangers should screen external data sources, heighten user awareness of external data valuable to the organizations and provide access to such data.

26: Database Administration: IS should increasingly use database administration to provide quality assurance of data holding across many end users and deal with information resource ownership concepts across the organization.

27: Integration of Technologies: IS management should ensure that current and future data processing, telecommunications and office automation technologies are integrated to prevent incompatibility.

28: End-User Computing: Organizations should

provide and increase support such as information centers and standardized hardware and software for end-user computing.

29: Office Automation: IS managers should take a leadership role in planning, implementing and managing office automation.

30: Decision Support Systems: IS should take a leadership role in planning, implement decision support systems that facilitate organization's decision making.

31: Artificial Intelligence and Expert Systems: IS managers should study artificial intelligence and expert systems now to plan for their use over the next several years.

32: Microcomputer Software Management: Initial selection of microcomputer software and subsequent upgrades should be better managed.

33: Mainframe Computing: IS management should provide more resources to improve mainframe computer services.

34: Technology Security: IS management should implement better physical security over information technologies, such as computers and peripheral devices.

35: Telecommunications Technology: IS management should ensure that long-term voice and data telecommunication decisions are made despite continuing technological changes, telecommunication deregulation, and the scarcity of experienced personnel.