Development of the Information Systems Implementation Research Method

Kai R. T. Larsen
Leeds School of Business, University of Colorado at Boulder
kai.larsen@colorado.edu

Abstract

Through the use of a recently developed taxonomy of information systems implementation, a new research method is developed. The Information Systems Implementation Research Method (ISI-RM) allows the examination of IS implementation cases in a new way that leads to results that are standardized for easier adoption by variance researchers. The paper examines the use of ISI-RM on a single case study. While untested in this paper, the ISI-RM may also be used as a meta-analytic tool, extracting important factors from a multitude of existing case studies.

1. Introduction

After several decades of information systems (IS) research, one area has developed into a focal point of the field; namely IS implementation research. IS Implementation has been defined as "an organizational effort to diffuse an appropriate technology within a user community" [1, p. 231]. As the field developed, many different research methods were imported from other fields of research. With quantitative approaches initially gaining the highest level of acceptance [2], and qualitative approaches gaining acceptance during the last decade, the field now accepts both quantitative and qualitative research approaches [3]. While the results of qualitative research may sometimes be used by researchers applying quantitative approaches to similar research problems [4], some approaches are founded on the belief that the researcher should know nothing about previous writings on a research problem, such as grounded research [5].

Both approaches to research have led to extensive streams of research, which unfortunately are poorly integrated. Currently, a great deal of qualitative research is inaccessible to quantitative researchers. Part of the reason is the space demands of good qualitative research needs making publishing in journals that limits space per paper difficult. Another piece to the puzzle may be found in which journals publish good qualitative research, these were traditionally not the same journals aspired to, and in many cases even read, by quantitative researchers. In the final analysis, neither qualitative nor quantitative research reaches its potential.

This paper addresses the above problem by introducing a theoretically grounded new research method that carries the promise of more closely integrating existing quantitative and qualitative research on IS implementation. The method builds on an empirical taxonomy of antecedents to implementation success and is designed to provide a new viewpoint on implementation of information technologies. As a first step toward creating a research tool that reaches this potential, the method is tested on a single case study.

2. Implementation Research

The main purpose of traditional implementation research has been to identify the factors relevant to implementation success [6]. Unfortunately, this vein of research, often referred to as "factor studies," has proven inadequate in terms of explaining links between the variables involved in information systems implementation. This view is supported by Paré and Elam [6], who cite two specific limitations of the factor approach: 1.) that these studies can help us understand only part of the implementation puzzle and 2.) that they cannot help us explain the dynamics of the implementation process. According to Paré and Elam [6], researchers have

> …built models that identify a limited set of critical factors affecting IT implementation success, but [researchers] know very little about *how* and *why* the factors included in these models interact and work together to produce success or failure. As a result, [management information systems] researchers lack a full understanding of the IT implementation process

Proceedings of the 36th Hawaii International Conference on System Sciences (HICSS'03)
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> that is necessary to guide practitioners to attain positive outcomes (p. 543).

Adding support, Larsen [7], when examining IS implementation research, found hundreds of independent variables used in studies, most of which had overlapping or even identical definitions. Using hermeneutics, Larsen [7] developed a taxonomy of 63 focal independent variables that may affect the success of an IS implementation (see Table 1).

Letting case studies represent qualitative research (Case studies may, of course, also contain quantitative approaches), it may be useful to examine strengths and weaknesses. Galliers [8] suggested that case studies have the following strengths: 1) they capture "reality" in greater detail than most other methods, and 2) they allow

VARIABLES	ARTIFACTS
Individual variables	
Attitudes toward computers	
Computer literacy	
Cosmopolitanism	
Dogmatism	
Education	
Gender	
Job expertise	
Job tenure	
Level in organization	
Task variables	
Task analyzability	
Task autonomy	
Task difficulty	
Task identity	
Task interdependence	
Task feedback	
Task uncertainty	
Task variety	
Structure variables	
Centralization	
Department integration	
Formalization	
Informal network	
Organizational size	
Specialization	
Technology variables	
Compatibility	
Ease of use	
Image	
Observability	
Relative advantage	
Trialability	
Voluntariness	
Process variables	
Change	
Computer training	
Elapsed time	
Equipment availability	
Extent of planning	
Information intensity	
IT maturity	
MIS centralization	
MIS department capabilities	
Organizational time frame	
Project development strategy	
Project team composition	
Resource availability	
Stakeholder involvement	
User involvement	
Customer involvement	
Degree of participation	
Champion promotion	
Management support	
Stakeholder participation	
User participation	
Management involvement	
Politics	
Interorganizational variables	
Interorganizational intensity	
Interorganizational power	
Resource interdependence	
Socio-political processes	
Environmental variables	
Environmental ambiguity	
Environmental competition	
Environmental complexity	
Environmental dynamism	
Environmental heterogeneity	
Environmental hostility	
Environmental turbulence	
Environmental uncertainty	

Table 1. The Categories and Variables of the ISI Taxonomy.

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the analysis of more variables than is possible with most other approaches. In terms of weaknesses, Galliers suggests that case studies: 1) are restricted to a single event/organization, 2) are hard to generalize from, 3) suffer from a lack of control of variables, and 4) allow different researchers and stakeholders to interpret the same events differently. While the above weaknesses are disputed by Klein and Myers [9], they provide a reasonable view of the methods when comparing them on equal footing, with perhaps a slight slant towards quantitative research.

While quantitative researchers have a host of methods and techniques at their disposal, the most common approach to data-collection when researching information systems implementation is the use of surveys. Galliers suggested that surveys have the following strengths: 1) ability to study a greater number of variables than with experimental approaches, 2) ability to describe real-world situations, and 3) ease of use and ability to generalize to other situations. At the same time, surveys have the weaknesses of: 1) not being good at generating insights about causes or processes behind the phenomena being studied, 2) possible bias in terms of respondent self-selection, 3) possible bias by the researcher, and 4) possible bias in the time in which the research is undertaken.

An examination of the IS implementation literature suggests that there may one especially prevalent issue to address; the gap between research findings produced using quantitative vs. qualitative approaches.

3. The ISI Research Method

This paper attempts to address the issues outlined in the first two sections by creating a new research method, the ISI research method as outlined in this section.

Going through the eight stages of the ISI-RM, examples are given from a New York State ERP implementation when appropriate. The Information Systems Implementation Research Method (ISI-RM) consists of several distinguishable steps. This section will describe each step:

1. Implementation setting familiarity
2. ISI taxonomy familiarity
3. Data gathering
4. Coding
5. Sorting
6. Analysis
7. Model development
8. Assessment of reliability

1. Gaining familiarity with the implementation setting. The first step of ISI-RM is to understand the research setting, and produce a miniature case study that will establish a timeline and history for the implementation effort.

2. Preparing and gaining familiarity with ISI taxonomy. The ISI taxonomy [7] consists of seven categories: individual, task, structure, technology, process, interorganizational, and environment. Each category contains between four and 15 variables, for a total of 63, depending on the needs of the researcher. Table 1 outlines the categories and the variables in the ISI-RM. Each category is defined in Appendix A, while

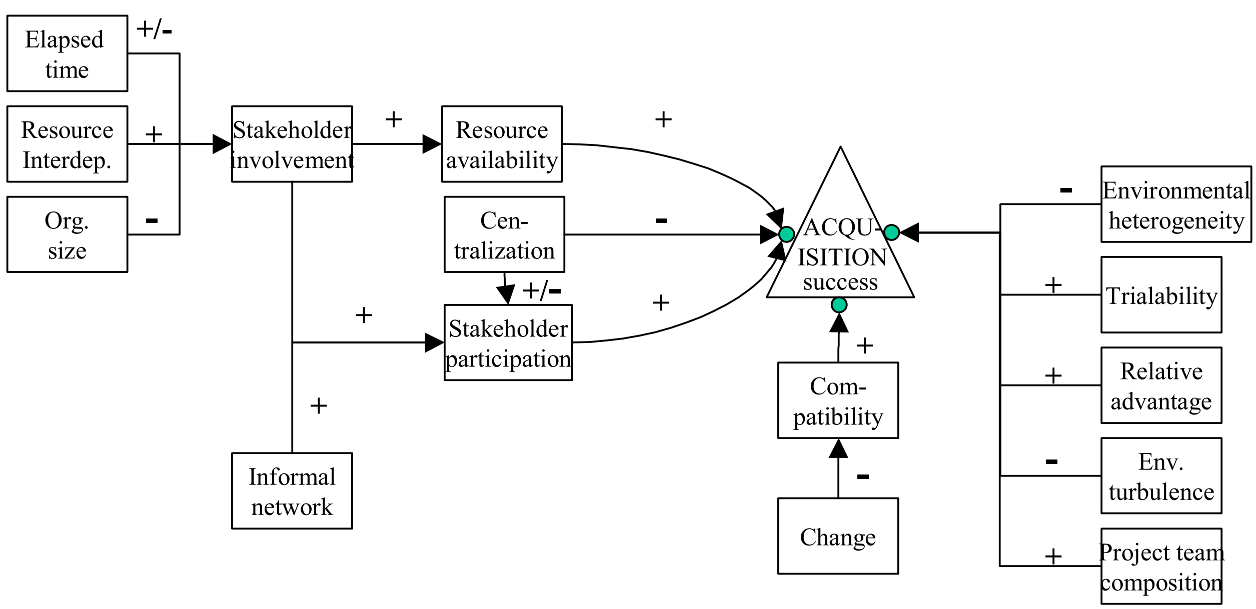

Figure 1. Example model from NY ERP Project

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examples of variables from each category are defined in Appendix B. Wallis and Roberts [10] suggested that categories should be chosen for their pertinence to the subject being studied. The ISI taxonomy was developed to reflect the very complex reality of information systems implementation and serves to connect a researcher's current project with the state of the art of quantitative research on information systems implementation.

3. Data gathering. When interviewing stakeholders, first apply an indirect and open-ended approach that gives the respondent the opportunity to discuss what led to the success or failure of the project without being constrained by the ISI taxonomy. The researcher should then ask the respondents to list the ways in which "factors" within each of the seven categories may affect success. The respondents should only be given the definitions of categories (Appendix A).

4. Coding. In this step the textual responses from the respondents are transcribed and coded into "atomic" units referred to as *artifacts*. Each artifact is a unit of text that describes a "factor" that a respondent believes was important in leading to success or failure of the implementation. Below are two example artifacts, one from the process category and one from the interorganizational category:

> "A tremendous amount of effort has gone into making [the system] easy to use, both by [the vendor and by the customization process]" (Probation Officer)

> "Interorganizational relationships between DCJS, who I represent, and DPCA staff has been critical. I mean, we have indeed met almost on a weekly basis, and involved and exchanged ideas back and forth" (Project Participant).

5. Sorting. The next step in developing the ISI-RM derived support from Yin's [11] statement that "[f]or case study analysis, one of the most desirable strategies is to use a pattern-matching logic" (p. 106). Yin [11] went on to say that such logic compares an empirically based pattern with a predicted pattern. In the ISI-RM, the ISI taxonomy represents the predicted pattern. It is expected to be reasonably complete in terms of variables that may affect the success of an information systems implementation. In cases where the taxonomy is not complete, its use will actually lead to its expansion.

The first task for the researcher is to do a first-level sort. That is, sort the list of artifacts using the definitions for the seven categories of the model (see Appendix A). By reading and having the seven categories readily available, the researcher should be able to finish the categorical sort with each artifact assigned to one category. In case an artifact does not fit into any of the seven categories, a new category and new focal variable may be created. When analyzing the ERP implementation project, a majority of the artifacts, 46, fell into the process category, and the structure category had the second most artifacts, 20. Then came the technology category with 14 artifacts, the individual category with 12 artifacts, the interorganizational category with eight artifacts, the environmental category with six artifacts, and finally the task category with three artifacts. In addition to these, four new artifacts were discovered.

The researcher should now have a set of artifacts sorted into each of the seven categories. The next step is to do a second-level sort of the artifacts into each category's variables. The researcher should proceed by preparing the definitions of variables for each of the categories, starting for example with the *structure category*. To those definitions, a "does not fit" variable should be added. Any time an artifact is added to the "does not fit" variable, it should be examined for multiple factors. If applicable, the artifact should be split into the component factors, and put back into the group of unsorted artifacts. When all seven categories have been examined in such a fashion, the unsorted group of artifacts should be put through another first-level sort, to be followed by seven second-level sorts. This process should be repeated until all artifacts have been placed. Items not placed should be given extra attention as they represent potentially new developments that may be unique for specific technologies or settings.

Categories/variables	Artifacts
Individual variables	**(12)**
Attitudes toward computers	5
Computer literacy	5
Job tenure	2
Task variables	**(3)**
Task feedback	3
Structure variables	**(20)**
Centralization	9
Department integration	2
Informal network	7
Organizational size	2
Technology variables	**(14)**
Compatibility	4
Ease of use	3
Relative advantage	5
Trialability	2
Process variables	**(46)**
Change	4
Computer training	5
Elapsed time	6
Equipment availability	2
MIS department capabilities	2
Project team composition	2

Resource availability	6
Stakeholder involvement	11
Stakeholder participation	8
Interorganizational variables	**(8)**
Interorganizational intensity	3
Resource interdependence	3
Socio-political processes	2
Environmental variables	**(6)**
Environmental heterogeneity	2
Environmental turbulence	4

Table 2. Number of Items Sorted into Each Category of the ISI taxonomy

6. Analysis. The next step is to examine the individual variables containing artifacts. Whereas this analysis will vary depending on research goals, a typical approach will be to write up the evidence from each variable while keeping the definition of the variable in mind. This may lead to insights into the workings of a variable and to knowledge about *why* this variable was important in the case(s) under examination.

7. Model development. As soon as the individual variables are analyzed, it is important to examine relationships between individual variables. If information about the origins of individual artifacts has been meticulously recorded, this information may give clues about those relationships. Next, after the researcher has used available information and logic to develop a working model, the model should be presented to the respondents for their comments. By also getting perceived weights of the variables, unimportant variables may be removed to allow for a pithy model.

Depending on the nature and purpose of the research project, the results may be written up as a testable model or as specific practitioner guidelines; regardless, the researcher should at this point have the necessary knowledge to write up the research results in a coherent and re-testable manner that is integrated with a large body of existing research in the field. An example model is outlined in Figure 1, and represents the variables found to be important by the respondents, and an initial attempt to explicate the relationships between those variables.

8. Assessment of reliability. If two or three researchers are working on a project, it is recommended to decide on the necessary level of agreement between the researchers before an artifact is placed into the ISI taxonomy. An appropriate measure of inter-rater reliability should also be established. Inter-rater reliability (IRR) is a "straightforward way to measure the reliability of nominal-scale coding [when] two or more persons independently code a subsample of the data" [12, p. 260]. The actual use of IRR is not covered in this paper. For an introduction to IRR, see [12-16]. Using Landis and Koch's [16] approach, a sub-set of the available artifacts were sorted by three researchers, and the agreement between raters was examined. The findings of the analysis was that the lower bound of the research method, as calculated after this exercise is *pi* = .39 for agreement between two of the three raters. As defined by Craig (1981), that statistic denotes a "fair" strength of agreement. However, when interviewing the raters after the exercise, two cards were found to contain two separate variables and one card contained three separate variables. Removing those cards from the analysis resulted in an upgrade of the statistic to *pi* = 1.00, denoting an "almost perfect" strength of agreement. Obtaining this degree of IRR indicates a robustness that holds promise for the future use of the method.

4. ISI-RM Assessment

ISI-RM may be assessed using Cameron and Whetten's [17] set of effectiveness questions. By rewriting the questions to focus on success, rather than effectiveness, these questions may facilitate understanding of how the ISI-RM can support research on information systems implementation success. The rest of this section answers Cameron and Wetten's [17] questions, which were:

(1) What is the purpose of assessing success?
(2) What level of analysis is being used?
(3) From whose perspective is success assessed?
(4) On what domain of activity is the assessment focused?
(5) What time frame is being employed?
(6) What types of data are being used in the assessments?
(7) What is the reference against which success is being judged?

1. *What is the purpose of assessing success?* Knowing the difficulties of such measurements, one can ask why researchers have tried so hard to do it. There are several answers to that question. First, organizational investments in IT are staggering [18, 19] and perceptions of price/performance are slipping [20, 21]. Second, IT-departments are under increasing pressure to demonstrate the value of Information Systems [22-24]. Third, as much as 75% of all systems development undertaken is never completed or is not used if completed [25]. Studies show that a high percentage of all information systems projects or systems fail. Fourth, such research must be carried out to justify the existence of an industry and a field of academics. If there are no benefits, why implement technology and why do research on technology? Finally, and most important for the ISI-RM, without a way to

define success or failure, it is not possible to improve upon practices or understand what leads to success. Only by knowing which information systems implementations were successful can we use them as best practices or conduct research to identify which factors make information systems implementation successful. All of the reasons above combine to form powerful support for any new research method that helps researchers better understand what leads to success during implementation of information systems. Such understanding would hopefully be applied in practical settings, thereby leading to a higher percentage of successful projects.

2. *What level of analysis is being used?* Here, two levels of analysis are discussed: micro and macro. At the micro level, the researcher analyzes the extent to which the information system satisfies the requirements of the organization's members. At the macro level, the whole organization or parts of it are the focus. Several different types of macro level analysis have been used: stakeholder, application, firm, and sector [26]. In the ISI-RM, the focus is simultaneously on the individual, application, project, organization, and sector levels. This means that the ISI-RM facilitates a comprehensive approach to understanding what factors lead to success.

3. *From whose perspective is success assessed?* This question does not apply to the ISI-RM, since the method may be used to analyze success from several perspectives, such as the task perspective or the individual perspective. Nevertheless, researchers using ISI-RM should examine the built-in biases of their respondents. It was clear through the analysis that management respondents proposed different variables as important than did users of the system.

4. *On what domain of activity is the assessment focused?* The ISI-RM enables researchers to quickly tap into existing IS implementation research and integrate knowledge about an emerging technology with existing knowledge about IS research. Further, the method may be used as a "meta-analysis" method to examine a large volume of existing case studies, thereby integrating a volume of quantitative and qualitative research. Currently, no similar method or technique exists for this domain of activity.

5. *What time frame is being employed?* Brynjolfsson [19] suggested that due to the learning curve, systems have a lag in terms of delivering benefits. It would be optimal to analyze a system at many points in time: before implementation, during implementation, right after implementation, and at regular intervals following the implementation. The ISI-RM contains no restrictions on when it should be used. It may be used either during an implementation or after it.

6. *What types of data are being used in the assessments?* As discussed earlier, both primary and secondary data may be collected and analyzed with the ISI-RM. Two separate protocols were developed to facilitate the different types of data gathering, one of which was discussed in this paper.

7. *What is the reference against which success is being judged?* Grover, et al. [27] used the concept of *evaluative referent* to describe this question. According to the authors, the concept describes "the relative standard that is used as a basis for assessing performance" [27, p. 180]. Four evaluative referents are generally recognized. The first is the goal-centered

	Advantages	**Disadvantages**
Case Study	1. Studies real-world situations 2. Captures reality in great detail 3. Enables analysis of many variables 4. Is good for study of processes 5. Is appropriate for emerging technologies	1. Is restricted to single event/ organization 2. Is difficult to generalize 3. Lacks control of variables 4. Suffers from interpretation bias
Survey	1. Studies real-world situations 2. Is easy to use 3. Is generalizable	1. Is weak on cause and effect and processes 2. Suffers from self selection bias 3. Suffers from researcher bias 4. Suffers from temporal bias.
IRM	1. Studies real-world situations 2. Captures reality in reasonable detail 3. Enables analysis of many variables 4. Is appropriate for emerging technologies 5. Is generalizable 6. Avoids researcher selection bias	1. Weak on cause and effect and processes 2. Suffers from temporal bias 3. May be difficult to use? (needs further testing)

Table 3. Elements of Research Methods

approach [28, 29], in which the researcher evaluates the degree to which goals or objectives of a system are achieved. The second is comparative judgment [27, 28], in which the researcher assesses the success of a system relative to similar systems. This approach is often referred to as benchmarking. Third is normative judgment [28] or system-resource approach [29], in which the system is compared to a theoretically ideal system. Fourth is improvement judgment [27, 28], in which the researcher assesses the extent to which the system has improved over time. The ISI-RM's focus is on what leads to success, not how to measure success. However, researchers using the ISI-RM have to define the evaluative referent carefully, especially in cases where the ISI-RM is used for meta-analysis. The value of research results will depend as much on choice of the evaluative referent as on the actual findings generated by use of the ISI-RM.

5. Conclusions

As discussed earlier, Galliers [8] and Benbasat, et al. [30] outlined some advantages and disadvantages of both case study research and survey research.

Table summarizes those advantages and disadvantages along with advantages and disadvantages of the ISI-RM. Table clearly shows that no method is perfect but that each approach has strengths that allow it to contribute to the whole picture of information systems implementation. Comparing the ISI-RM to case study and survey research methods shows that it combines some of the strengths of case studies with the strengths of survey research. Like the other approaches, the ISI-RM allows the researcher to study real world situations. It captures reality in more detail than survey research but in less detail than case study research. The ISI-RM enables the researcher to study more variables than is possible with survey research but potentially less than for case study research.

Like case study research, the ISI-RM is appropriate for emerging technologies. However, unlike case studies, the ISI-RM allows the research results to be used directly in survey research. When the meta-analysis protocol is used, the ISI-RM has great potential for generalizability, whereas when the case study protocol is used, the ISI-RM has no more generalizability than a case study. Unlike survey research, the ISI-RM avoids researcher bias in terms of selection of variables for the study. Whereas the survey researcher must select a few variables for analysis at the outset, the ISI-RM takes no stand on which specific variables are important for one or a set of implementations.

In terms of disadvantages, the current version of the ISI-RM is weak on cause-and-effect relationships and on examination of processes. Even so, the ISI-RM is clearly better at examining processes than most survey research. The final disadvantage of the ISI-RM is that it may be difficult to use. Though this has not been demonstrated, it is clear that the researcher must be able to understand a number of different definitions before using the method. However, the relative ease at which some test-researchers grasped the definitions and agreed on placement of items bodes well.

When comparing this new research method with existing research methods, the question is not which is best but rather how the different methods complement each other. Use of the ISI-RM clearly has the potential to bring results from case study research and survey research closer together. It promises to become a valuable method in the important goal of integrating two traditionally separate research streams: qualitative and quantitative implementation research. Both approaches bring something important to the information systems implementation area, and both have the potential to help the research area take a step forward. With the ISI-RM, research may be better informed in the future.

6. Bibliography

[1] T. H. Kwon and R. W. Zmud, "Unifying the Fragmented Models of Information Systems Implementation," in *Critical Issues in Information Systems Research*, R. Boland and R. Hirschheim, Eds. Chichester: John Wiley & Sons, 1987, pp. 227-251.

[2] W. J. Orlikowski and J. J. Baroudi, "Studying Information Technology in Organizations: Research Approaches and Assumptions," *Information Systems Research*, vol. 2, pp. 1-28, 1991.

[3] E. Mumford, "Information Systems Research - Leaking Craft or Visionary Vehicle," presented at IFIP TC8/WG 8.2 Working Conference on the Information Systems Research Arena of the 90's. Challenges, Perceptions, and Alternative Approaches, Copenhagen, Denmark, 1991.

[4] G. B. Davis, "A Strategy for Becoming a World-class Scholar in Information Systems." Carlson School of Management: University of Minnesota, 1994.

[5] N. F. Pidgeon, B. A. Turner, and D. I. Blockley, "The use of Grounded Theory for conceptual analysis in knowledge elicitation," *International Journal of Man-Machine Studies*, vol. 35, pp. 151-173, 1991.

[6] G. Paré and J. J. Elam, "Using Case Study Research to Build Theories of IT Implementation," in *Proceedings of the IFIP TC8 WG 8.2: Information Systems and Qualitative Research*, A. S. Lee, J. Liebenau, and J. I. DeGross, Eds. Philadelphia, PA: Chapman & Hall, London, England, 1997, pp. 542-568.

[7] K. R. T. Larsen, "A Taxonomy of Information Systems Implementation," *Leeds School of Business Working paper*, 2002.

[8] R. D. Galliers, "Choosing Appropriate Information Systems Research Approaches: A Revised Taxonomy," presented at IFIP TC8/WG 8.2 Working Conference on the Information Systems Research Arena of the 90's. Challenges, Perceptions, and Alternative Approaches, Copenhagen, Denmark, 1991.

[9] H. K. Klein and M. D. Myers, "A set of Principles for Conducting and Evaluating Interpretive Field Studies in Information Systems," *MIS Quarterly*, vol. 23, pp. 67-94, 1999.

[10] W. A. Wallis and H. V. Roberts, *Statistics: A New Approach*. New York, NY: The Free Press, 1956.

[11] R. K. Yin, *Case Study Research, Design and Methods*, Second edition ed. Beverly Hills, CA: Sage Publications, 1994.

[12] R. T. Craig, "Generalization of Scott's Index of Intercoder Agreement," *Public Opinion Quarterly*, vol. 45, pp. 260-264, 1981.

[13] D. Armstrong, A. Gosling, J. Weinman, and T. Marteau, "The Place of Inter-rater Reliability in Qualitative Research: An Empirical Study," *Sociology*, vol. 31, pp. 597-606, 1997.

[14] J. M. Morse, "'Perfectly Healthy, but Dead': The Myth of Inter-rater Reliability," *Qualitative health Research*, vol. 7, pp. 445-447, 1997.

[15] W. A. Scott, "Reliability of Content Analysis: the Case of Nominal Scale Coding," *Public Opinion Quarterly*, vol. 19, pp. 321-25, 1955.

[16] J. R. Landis and G. G. Koch, "The Measurement of Observer Agreement for Categorical Data," *Biometrics*, vol. 33, pp. 159-174, 1977.

[17] K. S. Cameron and D. A. Whetten, *Organizational Effectiveness: A comparison of multiple models*. New York, NY: Academic Press, 1983.

[18] S. S. Roach, "Services Under Siege: The Restructuring Imperative," *Harvard Business Review*, vol. 69, pp. 82-91, 1991.

[19] E. Brynjolfsson, "The Productivity Paradox of Information Technology," *Communications of the ACM*, vol. 36, pp. 67-77, 1993.

[20] J. Bird, "The Trouble with IT," *Management Today*, pp. 90-92, 1994.

[21] Stackpole, "Back to Business," in *PC Week*, 1995, pp. 16-20.

[22] D. P. Cooke and E. B. Parrish, "Justifying Technology: Not Measuring Up," *CIO*, vol. 5, pp. 84-85, 1992.

[23] A. Crowley, "The New Metrics," in *PC Week*, vol. 28, 1994, pp. 26-28.

[24] B. Henry, "Measuring IS for Business Value," in *Datamation*, vol. 36, 1990, pp. 89-91.

[25] G. R. Gladden, "Stop the Life-cycle, I Want to Get Off," *Software Engineering Notes*, vol. 7, pp. 35-39, 1982.

[26] S. Smithson and R. Hirschheim, "Analysing Information Systems Evaluation: Another Look at an Old Problem," *European Journal of Information Systems*, vol. 7, pp. 158-174, 1998.

[27] V. Grover, S. R. Jeong, and A. H. Segars, "Information Systems Effectiveness: The Construct Space and Patterns of Application," *Information & Management*, vol. 31, pp. 177-191, 1996.

[28] A. H. Segars and V. Grover, "Strategic Information Systems Planning Success: An Investigation of the Construct and Its Measurement," *MIS Quarterly*, vol. 22, pp. 139-163, 1998.

[29] S. Hamilton and N. L. Chervany, "Evaluating Information Systems Effectiveness - Part II: Comparing Evaluating Viewpoints," *MIS Quarterly*, vol. 5, pp. 79-86, 1981.

[30] I. Benbasat, D. Goldstein, and M. Mead, "The Case Research Strategy in Studies of Information Systems," *MIS Quarterly*, vol. 11, pp. 369-386, 1987.

[31] D. R. Compeau and C. A. Higgins, "Computer Self-Efficacy: Development of a Measure and Initial Test," *MIS Quarterly*, vol. 19, pp. 189-211, 1995.

[32] K. J. Dunegan, D. Duchon, and M. Uhlbien, "Examining the Link Between Leader-Member Exchange and Subordinate Performance - the Role Of Task Analyzability and Variety As Moderators," *Journal of Management*, vol. 18, pp. 59-76, 1992.

[33] G. E. Kloglan, R. D. Warren, J. M. Winkelpleck, and S. K. Paulson, "Interorganizational Measurement in the Social Services Sector: Differences by Hierarchical Level," *Administrative Science Quarterly*, vol. 21, pp. 675-688, 1976.

[34] E. M. Rogers, *Diffusion of Innovations*, Third Edition ed. New York, NY: Free Press, 1983.

[35] M. Igbaria, N. Zinatelli, P. Cragg, and A. L. M. Cavaye, "Personal Computing Acceptance Factors in Small Firms: A Structural Equation Model," *MIS Quarterly*, vol. 21, pp. 279-305, 1997.

[36] A. H. Van de Ven and D. L. Ferry, *Measuring and Assessing Organizations*. New York, NY: Wiley, 1980.

[37] R. Sabherwal and W. R. King, "Decision Processes for Developing Strategic Applications of Information Systems: A Contingency Approach," *Decision Sciences*, vol. 23, pp. 917-943, 1992.

Appendix A. Cards with Categories

Individual
The tenure, or length that an employee has been in the organization, the job expertise, and the computer literacy of that employee.
Task
The predictability and analyzability of the assignments or jobs done by users. The autonomy and variety of the assignments or jobs, and the extent to which a user is able to follow a job from beginning until end. Finally, the extent of feedback about job performance.
Structural
The specialization of work within the

department, the centralization of decision making authority, and the clarity and details of guidelines regarding the duties and responsibilities of the position. The integration of functional areas within the department, and the informal network in the department. The size of the department
Technology Focal system's ease of use and compatibility with the probation departments. The advantages of using the focal system compared to the old way of doing work. The ability to observe and try out the system before purchasing it, and the maturity of existing technology.
Process The events that take place before, during, and after the implementation of the system. Includes extent of planning and management support at all levels, in addition to user involvement and participation. Also includes the extent of computer training and support afforded the users of the system in addition to the expertise and knowledge of the local MIS department.
Interorganizational The strength and nature of ties between the different organizations. Also, the extent to which the department needs external resources to reach its goals.
Environmental What happens outside of the organization and is not controllable by the organization. The environment includes the level of uncertainty and ambiguity of the department's situation, in addition to the competition for resources and the current and expected future distribution of the resources.

Appendix B – Example Variables

In this appendix, a few concepts are outlined, to help the reader understand the foundations for the paper. While Larsen's [7]taxonomy consists of approximately 63 concepts in seven categories, only one concept from each of the categories is outlined.

Individual category:
Computer literacy: The extent to which the user understands the focal technology without receiving additional computing support or computer training, as evidenced through past exposure to technology or users own judgment of capabilities. Definition based on Compeau and Higgins [31] and others.

Task category:
Task analyzability: "[T]he extent to which workers can follow unambiguous processes to solve task-related problems: that is, the degree to which the task is structured" [32, p. 62].

Structural category:
Centralization: The extent to which decision making power and authority is located at the top of the organization, and that decisions are made at the top and communicated down through a hierarchy. Definition based work by Kloglan et al. [33] and others.

Technology category:
Compatibility: *"Compatibility* is the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters" [34, p. 223].

Process category:
Computer training: The extent to which the user participated in training sessions about the general software on a computer, or on a specific implemented system. Other users, computer specialists, vendors, consultants, educational institutions, or friends may provide the training. Definition builds on Igbaria et al. [35].

Interorganizational category:
Interorganizational intensity: "[T]he strength of the network in terms of the amount of resource flow and the frequency of information flows between network parties" [36, p. 316]

Environmental category:
Environmental dynamism: The rate and unpredictability of change in external factors. Definition based on work by Sabherwal and King [37]