

A Concept Map of Information Systems Research Approaches

Rafael Gonzalez, TU Delft, Jaffalaan 5, 2628BX Delft, The Netherlands; E-mail: R.Gonzalez@tudelft.nl

Ajantha Dahanayake, Georgia College and State University, Milledgeville, GA 31061, USA; E-mail ajantha.dahanayake@gcsu.edu

ABSTRACT

This paper presents a simple concept map of the wide and diverse spectrum of information system (IS) research approaches, focusing on helping researchers in having an overview of what these approaches are, what they are grounded on and what methods are available for them. It considers research philosophy, methodology, and method. It should help researchers, especially those getting started in IS research, in getting acquainted with the approaches and in justifying their choices coherently.

1. INTRODUCTION

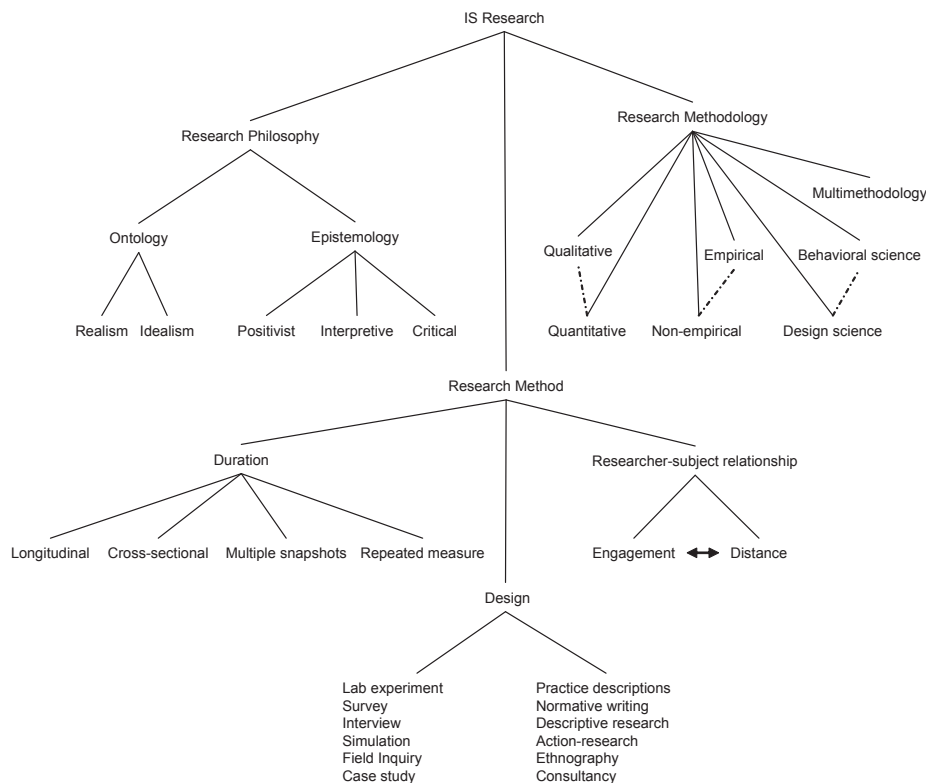
Research in information systems (IS) has received much attention and many different interpretations probably because the field itself is broad and multidimensional, as noted by Mingers (2001). Most researchers see IS as a social science or a socio-technical field (Hirschheim, 1992) and many disciplines (including management, sociology, computer science, and psychology, among others) are cited as informing its research and practice (Land, 1992; Checkland & Holwell, 1998). Walsham (2005) even reminds us that information systems are social and organizationally-embedded systems that use information and communication

technology (ICT) for what technology is supposed to be used: improving the lives of people. This socio-technical understanding of IS, has given rise to multiple approaches to IS research.

In this paper, we present a concept map of IS research for navigating through the different existing approaches, highlighting their differences, background and relationships. It must be noted that this paper is not about research in general, so it will omit many fundamental topics (such as variables, hypothesis, and induction versus deduction). Also, the authors' background is not in philosophy, so even though there is a lot of philosophical terminology, this paper is not about philosophy, it is about research in information systems. This paper is not about information systems development (ISD); even though similar classifications have been proposed for ISD, we will not be looking into development approaches or methods, only research. One final warning is that due to space limitations this paper takes a bird's eye view of the subject and should help as a guide, but detailed accounts of the approaches are outside the scope and as a consequence limits and definitions appear stricter than they really are.

On the next section we present the concept map itself and then go into each of its categories individually. Starting with the research philosophy in section three,

Figure 1. IS research concept map



followed by the research methodology in section four, further specified with the research methods in section five. Section six presents concluding remarks, concluding hints on how to select the research approach. The reference list in the end should also help in getting more detailed accounts and comparisons of the approaches.

2. INFORMATION SYSTEMS RESEARCH CONCEPT MAP

The following set of concepts related to IS research borrows ideas from different authors and does not provide absolute definitions, but rather a guide, especially aimed at budding researchers, of available approaches, how they differ from each other and what their philosophical grounds and available methods are. Because of its general view, it is quite possible that a concept may belong to more than one category and that some others may be left out. We will first look at the concept map in Figure 1 and then at its description on subsequent sections.

3. IS RESEARCH PHILOSOPHY

The research philosophy provides the ideological basis of a methodology. Typically, it is seen as composed of ontology and epistemology (Nandhakumar & Jones, 1997), but it may also embody ethics and axiology (Mingers, 2001), although we will not include these last two dimensions. Ontology refers to the nature of being (Nandhakumar & Jones, 1997), while epistemology refers to the theory of knowledge (how we acquire knowledge) (Hirschheim, 1992).

The dominating ontologies are realism and idealism, or more specifically:

- **External realism** – reality exists independently of individuals and their representations of it (Nandhakumar & Jones, 1997; Dobson, 2001; Hirschheim, 1992);
- **Internal realism** – reality is an intersubjective construction (Nandhakumar & Jones, 1997);
- **Critical realism** – sees science as a process of explanation and enlightenment, rather than a derivation of predictive laws, and states that structures can only be identified indirectly through their effects (Dobson, 2001); and
- **Idealism** – can be viewed in the sense of the early platonic World of Ideas, can be linked to German Idealism (Kant synthesizes concept and experience, Hegel sees consciousness as crucial for understanding and Fichte also sees consciousness as linked to the external world) (Hirschheim, 1992), or can be seen more generally as subjective idealism, in which reality is simply a construction of each individual (Nandhakumar & Jones, 1997).

We will dedicate the next subsections to epistemology. For IS research, some (Galliers, 1992; Wynn, 2001) have used a binary classification (empirical-interpretivist, quantitative-qualitative); others (Klein and Myers, 1999) offer a threefold classification of IS research (positivist, interpretive, critical), which we will use to distinguish epistemological foundations.

3.1. Positivist Approach

Positivism emphasises the role of science as the only method conducing to truth. It claims that the social world can be described by law-like generalizations stemming from collection of value-free facts (Nandhakumar & Jones, 1997; Chen & Hirschheim, 2004). It aims at verifiability or falsification of theories (*ibid.*). It believes in causality and usually takes on a quantitative-empirical methodological approach (*ibid.*; Hirschheim, 1992). Positivist research can be identified by the presence of: hypotheses, propositions, models, quantitative variables and statistic inference of “objective” data (Klein & Myers, 1999). Hirschheim (1992) describes positivism as based on five pillars: unity of the scientific method, search for causal relationships (through reductionism), empiricism, value-free science, and the logical and mathematical foundations of science. Positivism subscribes to an ontology based on realism, which sees the world as made up of immutable, observer-independent objects (*ibid.*; Chen & Hirschheim, 2004). The assumption is that the truth is out there and that it can be reached through the methods of science (Wynn, 2001). Extreme positivism in IS research sees technology as neutral, believes in rational management, ignores power relations and conflict, sees organizations as individual closed entities and focuses on the business environment (Mitev, 2000). This method may be appropriate for the natural sciences (although also under scrutiny in this domain), but not for the social ones (Checkland & Holwell, 1998; Hirschheim, 1992) and since we have established that IS are social in nature, then it seems clear why many researchers consider

positivism inadequate for IS research. However, despite this criticism, it is still the dominant epistemology (Chen & Hirschheim, 2004).

3.2. Interpretive Approach

Interpretivism argues that both the researcher and the human actors in the phenomenon under study interpret the situation (Nandhakumar & Jones, 1997). Instead of generalization it aims at in-depth understanding (Chen & Hirschheim, 2004). Since researchers need to be engaged in the phenomenon, field studies are seen as most appropriate interpretive methods (*ibid.*). Interpretive research is identified with the presence of participant’s perspectives as primary sources of information analyzed against cultural or contextual circumstances (*ibid.*; Klein & Myers, 1999). Many advocate interpretivism as the most appropriate for IS intervention (*ibid.*, Checkland & Holwell, 1998). Interpretivism sees organisations as social (conversational) processes in which the world is interpreted in a particular way, which legitimates shared actions and establishes shared norms (*ibid.*). Interpretive approaches aim at understanding the IS context and the way in which actors draw on and interpret elements of context; furthermore, they question the utility of generalizations, emphasising on the insight obtained with descriptive efforts (Mitev, 2000). Interpretivism’s main methods are action research and ethnography.

3.3. Critical Approach

According to the critical approach, there is no way to infer that a given law is true, no matter how many instances are analysed (Hirschheim, 1992). This approach denotes a critical process of inquiry seeking emancipatory social change through revealing hidden agendas, inequalities and manipulations (Klein & Myers, 1999; Ceez-Kecmanovic, 2001). It is characterized by reflexivity (self criticism) and the belief that no one has the monopoly of truth (*ibid.*). Self-conscious criticism exposes ideological and political agendas bringing the possibility of emancipation to the actors involved: only by subjecting the imperatives of the system to the needs of its members could an organization be emancipated (*ibid.*). This emancipation should be reached through public discourse which allows understanding purpose rather than simply achieving consensual action (Panagiotidis & Edwards, 2001). Seeking an “ideal-speech situation” (even if unreachable at its core) allows participants to go through a public process of discursive will-formation, rather than accepting an arbitrary political rule from established authorities (Ulrich, 1983). In practice, this means that participants are given the same chance to speak, that they are regarded as accountable (truthful) and that they are given the chance to question each other from a higher level of abstraction; meaning that they can raise criticism to the foundations of an argument, not only to the argument itself. This implies changing the search for objectivity, to a search for discursive validity. Critical research is still seen as lacking sufficient clarity and intertwining between theory and practice and thus not widely embraced (McGrath, 2005).

4. IS RESEARCH METHODOLOGY

Defining research methodology is not easy, especially when trying to distinguish it from method or approach. One understanding is to see it as a systematic approach involving guidelines, activities, techniques and tools (Wynekoop & Russo, 1997). But this notion is more readily associated to method than to methodology (Mingers, 2001). We take the view that a methodology is a more abstract concept relating either to the study of methods or to a more general and less prescriptive approach than a method (*ibid.*; Checkland, 2000). As a complete definition we adopt the following:

“Methodology is understood here in its philosophical sense as an overall strategy of conceptualizing and conducting an inquiry, and constructing scientific knowledge. Methodology, therefore, refers not only to research methods or techniques (such as case study or interview), but also to the epistemological assumptions of methods and how they are linked to a particular theory.” (Ceez-Kecmanovic, 2001, p. 142)

On top of its philosophical underpinnings, a methodology can be qualitative or quantitative, empirical or non-empirical. There is another possible division between design science and behavioral science (Hevner & March, 2003) but we feel it is not general enough to be taken as the opposing poles for IS research

(technical versus social, in this case). In any case, both in practice and in theory it is quite possible to find a pluralist approach at combining methods in what is dubbed multimethodology.

4.1. Qualitative vs. Quantitative

Quantitative research has long dominated scientific inquiry through its pursuit of measurable, statistic, data-laden truths. Qualitative research has, however, emerged in IS with the recognition that it is a social field not subject to numeric measurement and that traditional approaches did not give an adequate understanding of its social nature. Qualitative research is motivated by Weberian assumptions that truths are approximate and by a shift in the use of IS to support social processes instead of just transactions (Wynn, 2001). Qualitative shouldn't be immediately associated with interpretivism or quantitative to positivism, since for example, surveys and questionnaires (quantitative in nature) can be used in interpretive research (Nandhakumar & Jones, 1997). Quantitative is the dominating tendency in IS, although qualitative research is on the rise (Chen & Hirschheim, 2004).

4.2. Empirical vs. Non-Empirical

Empirical research, based on observation or experience, is typically regarded as "scientific" because it is repeatable, refutable, objective and rigorous. Non-empirical (sometimes equated to interpretive) research has different interpretations of social phenomena, recognizes the influence of the scientists over the studied situation and highlights the difficulty in forecasting human activity (Galliers, 1992). Although some radical scientists claim that "if it can't be measured it's not real", we have seen how different approaches, from the social sciences, have increasingly been used in IS research (*ibid.*).

4.3. Multimethodology

Methodological pluralism is based on the idea that diversity (inherent in information systems) implies strength, since different methods provoke different responses, which means that complex situations benefit from different methods (Mingers, 2001). Although philosophical, cultural, psychological and practical barriers may hinder its use, Mingers (*ibid.*), a long-time advocate of pluralism, has argued it is feasible in all these issues. Pluralism has been used both as a way to transcend positivism (and its criticism) (Hirschheim, 1992) and as a way to combine behavioral and design science (Hevner & March, 2003).

5. IS RESEARCH METHOD

The research method is understood here as more specific than a methodology: it is the systematic approach to inquiry which implies skills, assumptions and practices as the bridge, so to speak, between the methodology and the actual design of the research. Thus, the method defines, informed by a methodology, the type of research in terms of duration, researcher-subject relationship and design (for lack of a better word): methodology leads to method in the form of the specific things the methodology user chooses to do in a particular situation (Checkland, 2000).

5.1. Method According to Duration

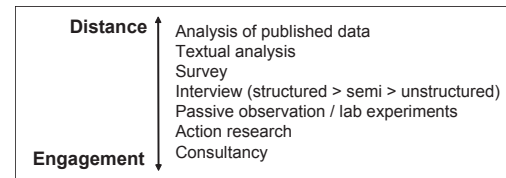
In terms of duration, a method can have different levels of time-related involvement. They can be categorized into (Chen & Hirschheim, 2004):

- Longitudinal (evolves over uninterrupted period of time and focuses on process),
- Cross-sectional (collects data through one snapshot at a particular point in time),
- Multiple snapshots (cross-sectional with more than one data collection), and
- Repeated measure design (various time periods to examine evolution of phenomenon).

5.2. Method According to Researcher-Subject Distance

The magnitude of the distance between the researcher and the subjects (or participants) can change within a single inquiry, but it helps to previously consider what that engagement might be and decide on how close we need to be to gain the most insight; a helpful range, according to distance is presented in Figure 2.

Figure 2. Distance and engagement in IS research, adapted from (Nandhakumar & Jones, 1997)



5.3. Method According to Design

Finally, the research method may be supported in different designs, although most imply a whole methodology when used. The reason they are considered method, rather than methodology is because we have already stated that methodology indicates philosophical strategy and assumptions. This means that, for instance, case study and action research can be conducted qualitatively or quantitatively, but only when making that clear does it become a full methodology. This argument is, however, debatable. The following are some of the most used methods:

- **Normative writing:** concept development not based on empiricism or theoretical grounding, but on speculation or opinion (Wynekoop & Russo, 1997).
- **Lab experiment:** studies within a designed, controlled environment, which typically include contrasting related variables (Chen & Hirschheim, 2004).
- **Field Inquiry:** generally speaking, field inquiry may involve case studies, action research or ethnography; particularly, a field experiment is an experiment which is designed in the spirit of a lab experiment but is carried out in the real world (*ibid.*).
- **Case study:** an empirical inquiry that investigates a contemporary phenomenon in real life, when boundary and context are not clearly evident or the prior knowledge of constructs and variables is inferior, differentiating it from field studies (Yin, 1994; Darke *et al.*, 1998). The case study can take a positive or interpretive epistemological approach and is thought to be particularly appropriate for the study of information systems within organizations (*ibid.*).
- **Action-research:** Action research, in contrast with a case study (although it may be part of one), is concerned with actual planned change and production of theory in the process (Avison *et al.*, 2001). It is assumed as a never-ending learning cycle in which informed practice improves a social system and feeds-back on theory. Baskerville and Wood-Harper (1998) point out some of action research's main characteristics: (1) multivariate social settings, (2) interpretive assumptions about observation, (3) intervention by the researcher, (4) participatory observation and (5) the study of change in the social setting.
- **Descriptive research:** Interpretive research studying literature or past research or events (Wynekoop & Russo, 1997).
- **Practice Descriptions:** descriptions of a practitioner with implicit bias and no *a priori* research intent (*ibid.*). These are of course hard to place within a rigorous scientific structure, but can still find a place within certain academic communication outlets.
- **Consultancy:** although mainly regarded as a source of income, consultancy may be strongly related to (or regarded as) research when conducted by university staff (Freestone & Wood, 2006) or indeed considered as a research method, at least for management science (Nandhakumar & Jones, 1997).
- **Simulation:** as a research method, simulation is used for prediction and explanation in numerous disciplines, helping researchers identify universal principles and processes of the real world, formalized into models, which can then offer new cognitions (Becker *et al.*, 2005).
- **Ethnography:** coming from anthropology, ethnographic research requires that the researcher immerse him or herself for a longer period of time than a case study in an unfamiliar situation, seeking to place the phenomena in a social and cultural context and relying heavily on detailed first-hand observational evidence (Myers, 1999). Ethnography is increasingly being used in computer systems development as pointed out by Wynn (2001).

There are also some research instruments that usually make part of some of the above designs, but sometimes may be sufficient as methods themselves. Two common cases of such instruments are:

- **Survey:** gathering data through questionnaires (Chen & Hirschheim, 2004).
- **Interview:** an interview can be associated to other research designs (most notably case study) mainly as a data collection technique; as a qualitative method, it seeks to describe the multiple realities of the subjects (Stake, 1995).

6. CONCLUDING REMARKS

Since all approaches have advantages and disadvantages, a first conscious criterion for selecting them is the context, which limits both the choice of methods and the way they are used (Cecez-Kecmanovic, 2001); this context includes the researcher's assumptions (Olesen and Myers, 1999). According to Trauth (2001), when choosing a research method, five factors come into play: the research problem, the researcher's theoretical lens, the degree of uncertainty surrounding the phenomenon, the researcher's skills and academic politics (at an institutional, disciplinary and cultural level). Fitzpatrick *et al.* (1998) further suggest that personality traits and skills are equally important as the topic, objective and questions and the idea is to find the best fit between the situation and the way to obtain conclusions from it.

How exactly these factors determine the choice is outside the scope of this paper, but we believe that by having awareness of the possibilities and their background, the choice will be better informed. When in doubt, a researcher is probably better off following institutional tradition, supervisor preference or past experience. Also, it should be noted that even though political structures, reward systems and authorities are aware of the social or human side of things, they still favour and are guided by conservative methods (Trauth, 2001).

We believe that by using the concept map in Figure 1, a researcher can get acquainted with IS research approaches, know what decisions ought to be made, have an idea of how to justify them and employ the reference list when more detail is required. The main suggestion is to be coherent in the choices made, instead of forcing a design into an inadequate epistemology or even worse, using a design without even considering its underlying philosophy.

It is still possible to explain the concept map in much more detail and include some concepts that may have been left out. We believe that there have been several accounts of IS research, but there is a need for unifying them in order to help researchers, rather than to stimulate philosophical discussion or distinction among schools of thought (although this is also relevant).

REFERENCES

- Avison, D.; Baskerville, R. & Myers, M. (2001) "Controlling Action Research Projects", *Information Technology and People*, Vol. 14, No. 1, pp. 28-45.
- Baskerville, R and Wood-Harper, A. (1998) "Diversity in information systems action research methods", *European Journal of Information Systems*, Vol. 7, pp. 90-107
- Becker, J.; Niehaves, B. & Klose, K. (2005) "A Framework for Epistemological Perspectives on Simulation". *Journal of Artificial Societies and Social Simulation*. Vol. 8 No. 4.
- Cecez-Kecmanovic, D. (2001) "Doing Critical IS Research: the question of methodology" in Trauth, E. (Ed.) *Qualitative Research in IS: issues and trends*. Idea Group Publishing, Hershey.
- Checkland, P. (2000) "Soft Systems Methodology: A Thirty Year Retrospective". *Systems Research and Behavioral Science* 17, pp. 11-58, John Wiley & Sons.
- Checkland, P. & Holwell, S. (1998) *Information, Systems and Information Systems*. John Wiley & Sons, Chichester.
- Chen, W. & Hirschheim, R. (2004) "A paradigmatic and methodological examination of information systems research from 1991 to 2001". *Information Systems Journal*, No. 14, pp. 197-235, Blackwell Publishing Ltd.
- Darke, P.; Shanks, G. & Broadbent, M. (1998) "Successfully Completing Case Study Research: combining rigour, relevance and pragmatism". *Information Systems Journal*, No. 8, pp. 273-289, Blackwell Science.
- Dobson, P. (2001) "The Philosophy of Critical Realism—An Opportunity for Information Systems Research". *Information Systems Frontiers*, Vol. 3 No. 2, 199- 210, Kluwer Academic Publishers.
- Fitzpatrick, J.; Sacrist, J. & Wright, D. (1998) *Secrets for a Successful Dissertation*. Sage Publications, Thousand Oaks.
- Freestone, R. & Wood, D. (2006) "Exploring Strategies for Linking Research and Teaching". *Journal for Education in the Built Environment*, CEBE.
- Galliers, R. (1992) "Choosing Information Systems Approaches" in Galliers, R. (Ed.) *Information Systems Research: issues, methods and practical guidelines*, Alfred Waller Ltd., Henley-on-Thames.
- Hevner, A. & March, S. (2003) "The Information Systems Research Cycle". *Computer*, Vol. 36, Iss. 11, Nov. 2003, pp. 111-113, IEEE Computer Society.
- Hirschheim, R. (1992) "Information Systems Epistemology: an historical perspective" in Galliers, R. (Ed.) *Information Systems Research: issues, methods and practical guidelines*, Alfred Waller Ltd., Henley-on-Thames.
- Klein, H. & Myers, M. (1999) "A Set of Principles for Conducting and Evaluating Interpretive Field Studies in Information Systems". *MIS Quarterly* Vol. 23, No. 1, pp. 67-96.
- Land, F. (1992) "The Information Systems Domain" in Galliers, R. (Ed.) *Information Systems Research: issues, methods and practical guidelines*, Alfred Waller Ltd., Henley-on-Thames.
- McGrath, K. (2005) "Doing critical research in information systems: a case of theory and practice not informing each other". *Information Systems Journal*, 15, pp. 85-101, Blackwell Publishing.
- Mingers, J. (2001) "Combining IS Research Methods: Towards a Pluralist Methodology". *Information Systems Research*, Vol. 12, No. 3, September 2001, pp. 240-259, Informa.
- Mitev, N. (2000) "Toward Social Constructivist Understanding of IS Success and Failure: introducing a new computerized reservation system", *Proceedings of the twenty first international conference on information systems*, December, Brisbane, Queensland, Australia, pp. 84- 93.
- Myers, M. (1999) "Investigating Information Systems with Ethnographic Research". *Communications of the AIS*, Vol. 2, Article 23, pp. 1-20.
- Nandhakumar, J. & Jones, M. (1997) "Too Close for Comfort? Distance and engagement in interpretive information systems research". *Information Systems Journal*, No. 7, pp. 109-131, Blackwell Science Ltd.
- Olesen, K. and Myers, M. (1999) "Trying to Improve Communication and Collaboration with Information Technology: an action research project which failed", *Information Technology & People*, Vol. 12, No. 4, pp. 317- 332.
- Panagiotidis, P. and Edwards, J. (2001) "Developing Intrinsically Motivated Information systems – a critical systems approach", *Information Systems Frontiers*, Vol. 3, No. 2, pp. 211- 226, Kluwer Academic Publishers.
- Stake, R. (1995). *The Art of Case Study Research*. Sage Publications, Thousand Oaks.
- Trauth, E. (2001) "The Choice of Qualitative Methods in IS Research" in Trauth, E. (Ed.) *Qualitative Research in IS: issues and trends*. Idea Group Publishing, Hershey.
- Ulrich, W. (1983) *Critical Heuristics of Social Planning: a new approach to practical philosophy*, John Wiley & Sons, Chichester.
- Walsham, G. (2005) "Development, global futures and IS research: a polemic", *Journal of Strategic Information Systems*, Vol. 14, pp. 5-15, Elsevier.
- Wynekoop, J. & Russo, N. (1997) "Studying Systems Development Methodologies: an examination of research methods". *Information Systems Journal*, No. 7, pp. 47-65, Blackwell Science Ltd.
- Wynn, E. (2001) "Möbius Transitions in the Dilemma of Legitimacy" in Trauth, E. (Ed.) *Qualitative Research in IS: issues and trends*. Idea Group Publishing, Hershey.
- Yin, R. (1994) *Case Study Research: design and methods*. Second Edition. Sage Publications, Thousand Oaks.

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