Collaboration and Research Methods

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INTRODUCTION

The problems in practice are seldom solved by applying knowledge from one science only. The co-operation and collaboration between experts from different sciences are then needed. Customer relationships management (CRM) and supply chain management (SCM) systems strongly show that information technology (IT) is helping and supporting the collaboration needed. But the problems related with co-operation and collaboration can be different. I shall in this paper perform a small survey on the recent literature to demonstrate the variety of problems. The presented examples refer to different research methods required. The methods are structured into the new taxonomy in order to help a researcher to find a suitable research method for a certain research problem.

COLLABORATION

Collaboration is needed in many information technology (IT) efforts. To give some light to different opportunities, we give some examples below. We shall name them by letters A, B, ..., H and later use those letters in referring to our categories of research methods in the next section. Collaboration can be successful or unsuccessful. We start with the latter case.

Example A: The requirements specification plays a key role in building the new IT application. To my mind, Davidson [2002] nicely described her longitudinal case study with eight episodes. The project focused on defining requirements for a new marketing and sales system to replace an existing legacy system. The real project leader or the opinion leader changed at least eight times during the Davidson's follow up period. Depending on who was guiding the project work both the goals of the project and the sketches of specifications changed At the end of the study period any accepted specifications did not yet exist. Davidson applied the principles of interpretive field study presented by Klein and Myers [1999] to her case. If she would use Deetz's [1996] classification of four discourses, she would not call her study as interpretive but *dialogic* one, because there were not only one view on requirements but many.

Example B: Virkkunen and Kuutti [2000] studied a certain organisation at the public sector. They described inspectors' work in a labour-protection. They found many conflicting parties in the organisation, and therefore they selected the cultural historical activity theory to study organisational learning. On the basis of the historical analysis, the researchers prepared the model of the inspectors' activity system and its inner contradictions. This historical analysis really gave an important information. By using term, historical analysis it was no need to say anything bad about participants, and it psychologically laid a more sound basis for the development work than speaking about conflicts between some persons or between some collectives.

Example C: Lamb and Kling [2003] considered that a concept of the user is fundamental to much of the research and practice of information systems design, development, and evaluation. User-centered information studies have relied on individualistic cognitive models to carefully examine the criteria that influence the selection of information and communication technologies (ICTs) that people make. In many ways, these studies have improved our understanding of how a good information resource fits the people who use it. However, research approaches based on an individualistic user concept are limited. In their paper, they examined the theoretical constructs that shape this user concept and contrast these with alternative views that help to reconceptualize the user as a social actor. Despite pervasive ICT use, social actors are not primarily users of ICTs. Most people who use ICT applications utilize multiple applications, in various roles, and as part of their efforts to produce goods and services while interacting with a variety of other people, and often in multiple social contexts. Moreover, the socially thin user construct limits our understanding of information selection, manipulation, communication, and exchange within complex social contexts. Using the grounded theory approach [Glaser and Strauss 1967] in analyses from a recent study of online information service use, they developed an institutionalist concept of a social actor whose everyday interactions are infused with ICT use.

Example D: Jarvenpaa and Staples [2000] reported an exploratory investigation of individual perceptions of factors that underlie the use of collaborative electronic media (electronic mail, World Wide Web, list serves, and other collaborative systems) for sharing information in a large state university in Australia. The model builds on the Constant et al.'s [1994] theory of information sharing. The authors propose that perceptions of information culture, attitudes regarding information ownership and propensity to share, as well as task and personal factors influence people's use of collaborative media. Jarvenpaa and Staples found that task characteristics (task interdependence), perceived information usefulness and the user's computer comfort were most strongly associated with the person's use of collaborative media. Consistent with Constant et al.'s [1994] earlier findings, views of information ownership and propensity to share were significantly related to use. Interestingly, use of electronic media for sharing information and contacting people was weakly associated with a more structured, closed information culture. This implies that heavy users and sharers want more structured information flow in place, possibly due to their need to have reliable access to other individual's knowledge and information. Contrary to suggestions in the literature, a fully open, organic information culture may not always be most desirable.

Example E: van Aken [2004] studied approaches in design science. Concerning outcomes of design science studies he emphasises design knowledge, especially prescriptions as an important category. The logic of a prescription is 'if you want to achieve Y in situation Z, then perform action X'. There are algorithmic prescriptions, which operate like a recipe. However, many prescriptions in a design science are of a heuristic nature. They can rather be described as 'if you want to achieve Y in situation Z, then something like action X will help'. 'Something like action X' means that the prescription is to be used as a *design exemplar*. A design exemplar is a general prescription which has to be translated to the specific problem at hand; in solving that problem, one has to design a specific variant of that design exemplar." [van Aken, 2004]

"In the design sciences the research object is a '*mutandum*'; these sciences are not too much interested in what *is*, but more in what *can be*. The typical research product is the prescription discussed above or in terms of Bunge [1967b, p. 132] a technological rule: 'an instruction to perform a finite number of acts in a given order and with a given aim'. A *technological rule* is defined as *a chunk of general knowledge, linking an intervention or artefact with a desired outcome or performance in a certain field of application*. A major breakthrough occurred with the systematic testing of technological rules. The *tested* technological rule is one whose effectiveness has been systematically tested within the context of its intended use. The real breakthrough came when tested technological rules could be *grounded* on scientific knowledge [Bunge 1967b, 132], including law-like relationships from natural sciences. The typical research design to study and test technological rules is the multiple case: a series of problems of the same class is solved, each by applying the problem solving cycle. By borrowing concepts from software development one can say research on technological rules typically goes through a stage of *α-testing*, i.e. testing and further development by the originator of the rule, to be followed by a stage of *β-testing*, i.e. the testing of the rule by third parties."

As said earlier multiple case studies are valid for the extracting and the developing case study. The *extracting* multiple case-study [van Aken 2004] "is a kind of best-practice research and is aimed at uncovering technological rules as already used in practice. A good example of such research is the classical study of Womack et al [1990] of the automotive industry and especially of Japanese practices. This research has produced, among other things, a number of very powerful technological rules, like the Kanban-system and Just-in-Time delivery for driving a supply chain.

Example F: Lindgren et al. [2004] claimed that even though the literature on competence in organizations recognizes the need to align organization level core competence with individual level job competence, it does not consider the role of information technology in managing competence across the macro and micro levels. To address this shortcoming, we embarked on an action research study that develops and tests design principles for competence management systems. This research develops an integrative model of competence that outlines the interaction between organizational and individual level competence and the role of technology in this process. Six Swedish organizations participated in their research project, which took 30 months and consisted of two action research cycles involving numerous data collection strategies and interventions such as *prototypes*, and developing a set of design principles.

Lindgren et al. [2004] describe how it is possible to find out the competences of a certain worker by utilizing search engines and recommender systems with the document repository. This is a really new domain to apply IT, and March and Smith [1995], and Hevner et al. [2004] recommend that this kind of application should be included into the knowledge base of design science. The *evaluation* of two prototypes made by Lindgren et al. highlighted that their design principles generated not only anticipated but also unanticipated consequences. In light of these findings, they revised and refined their initial design principles.

Example G: Aulin [1982, 115] derived the Law of Requisite Hierarchy from the Law of Requisite Variety [Ashby, 1956] by supposing that a regulator R1 is incapable of reducing the variety of original disturbance H(D) to the required level of survival, $H(E_0)$. The situation may be saved, if we have another regulator R2 that can be put to regulate further the outcome

Y1 of the first regulator. This may be still insufficient. But then, if we have a third regulator to handle the outcome Y2 we can proceed and go until a regulator of order m will yield a satisfactory result. In general case, the uncertainty term $H_D(R)$ for m regulators in the sequence will reduce the effective regulatory ability. Some controllers Gj, or a hierarchy of controllers to guide regulators Ri are then needed.

The Law of Requisite Hierarchy can be expressed as follows:
The weaker in average are the regulatory abilities and the larger the uncertainties of available regulators, the more hierarchy is needed in the organization of regulation and control to attain the same result of regulation, if possible at all.

Example H: Gefen et al. [2003] performed a literature survey and found that a separate and distinct interaction with both the actual e-vendor and with its IT Web site interface is at the heart of online shopping. Previous research has established, accordingly, that online purchase intentions are the product of both consumer assessments of the IT itself – specifically its perceived usefulness and ease-of-use (TAM) – and trust in the e-vendor. But these perspectives have been examined independently by IS researchers. Integrating these two perspectives and examining the factors that build online trust in an environment that lacks the typical human interaction that often leads to trust in other circumstances advances our understanding of these constructs and their linkages to behaviour.

THE NEW TAXONOMY OF RESEARCH METHODS

In this section we present our taxonomy (Figure 1) and argumentation for it. We firstly differentiate mathematical methods from other methods, because they concern formal languages, algebraic units etc., in other words, symbol systems not having any direct reference to objects in reality. From the remaining methods concerning reality we then use research questions in differentiation. Two classes are based on whether the research question concerns a) what is a (part of) reality or b) does the question stress on utility of an innovation (artefact) [cf. March and Smith, 1995]. From the former we differentiate conceptual-analytical approaches, i.e. methods for theoretical development, from empirical research approaches.

When empirically studying the past and present, we can use theory-testing or theory-creating methods depending on whether we have a theory, model or framework guiding our research or whether we are developing a new theory grounded on the raw data gathered. In the theory-testing studies we can a priori assume either dissent or consensus [Deetz 1996]. In the theory-creating studies we recognize whether dissent or consensus holds in the research site. Concerning innovations, we can either build or evaluate them. - Above we have tried to apply the Bunge's [1967a, 75] guidelines to the taxonomy.

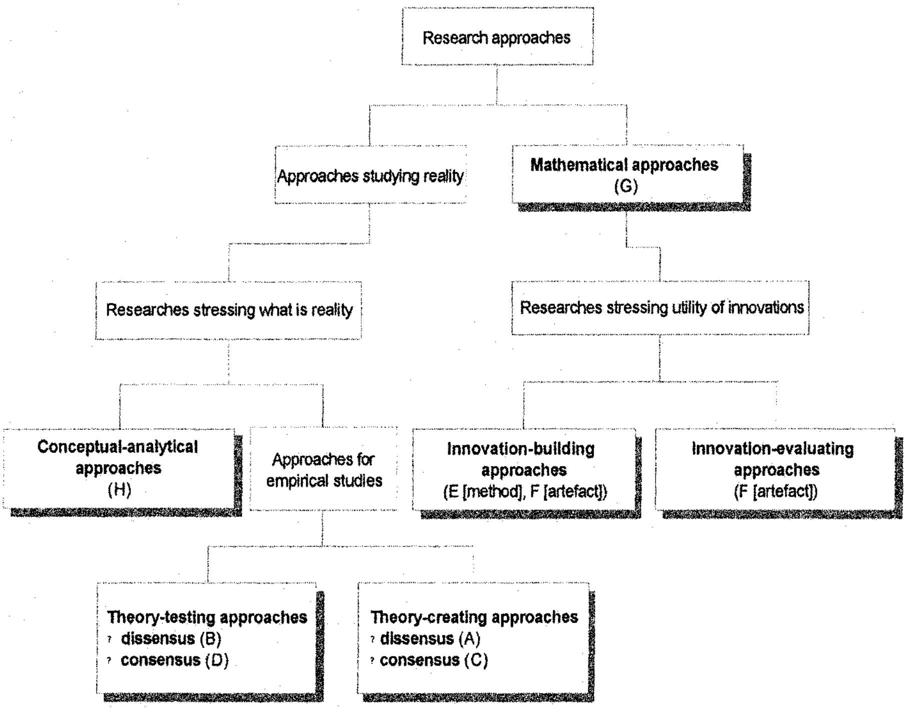

Figure 1. Our taxonomy of research methods [Järvinen, 2004]

March and Smith [1995] placed much emphasis on design science with two activities, *build* and *evaluate*. It is interesting to note that Susman and Evered [1978] described *action research* as a repetitive performance of the following cycle: Diagnose, plan, implement, evaluate and learn. The three first phases in the cycle (diagnose, plan and implement) are similar to the information systems development method, when the so-called phase approach is applied, i.e. when a new system is built. Hence, action research seems to contain both the build and evaluate activities.

Hence, our new taxonomy seems to give advice for researchers on how to select a suitable research method, and correct and improve earlier views on research methods.

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