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PARADIGMS AND INFORMATION SYSTEMS AS AN APPLIED DISCIPLINE – A MODEL-BASED REPRESENTATION, PROBLEMS, AND SUGGESTED SOLUTIONS

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Abstract

Information Systems Discipline (ISD) is dominated by the two contrary paradigms of design science on the one hand and behavioral science on the other. Apart from that, research results are considered more or less relevant for practice depending on the respective paradigm. Conclusively, research communities following the paradigms are partly incompatible while, due to the notion of relevance for practice, the exchange between science and practice is hampered. Various "disconnects" hindering the collaboration both between design science and behavioral science and between science and practice emerged due to this. These aspects will be described and represented within a model-based analysis of the situation while suggestions from ISD literature on the topic will be presented and discussed. Considering that comparable challenges have recently been faced in the field of medicine, Evidence-based Medicine (EbM) emerged as a new paradigm to solve similar problems and is now well-established. We will present and discuss some attempts to transfer the evidence-based research approach from medicine and how they may apply to the equally application-oriented field of Information Systems.

Keywords: Business & Information Systems Engineering Research, Information Systems Research, Design Science, Behavioral Science

1 Introduction

Information Systems Discipline (abbreviated ISD including Business & Information Systems Engineering Research (BISER) and Information Systems Research (ISR)) is an applied discipline, which is dominated by the construction-oriented paradigm (Design Science, DS) on the one hand and the opposing behavioral[1] (Behavioral Science, BS) paradigm[2] on the other. The difference between is resulting from regionally bound research traditions, diverse intellectual traditions, differences within the education of scholars of the field, etc. (Frank et al., 2008, p. 391; Junglas et al., 2011). BISER as prevailing within Europe and in particular within the German-speaking domain, deals usually with the construction of IT artifacts intended to contribute to the solutions of practical problems (WKWI 1994). Within the Anglo-American domain, in contrast, ISR deals with the explanation and prediction of phenomena resulting from the application of IT artifacts (Baskerville and Pries-Heje, 2010; Hevner et al. 2004, p. 76).

Considering the two opposing paradigms which create a "methodological divide" (Junglas et al., 2011, p. 3) both communities are challenged by a number of issues which can be raised. Generally speaking, ISR is known to rigorously apply quantitative-empirical research, focusing on a conclusive application of statistical methods as well as the interpretation of empirical data in order to empirically test hypotheses. The practical relevance of the results thus tends to be disregarded (e.g., Benbasat and Zmud, 1999; Lee, 1999; Moody and Buist, 2000) in favor of research rigor. Design-oriented BISER, however, typically addresses practical issues, contributing to the solution of such problems by creating innovative IT artifacts (Baskerville and Pries-Heje, 2010). However, the scientific rigor of construction-oriented research methods and as such their research results is criticized to some extent (Frank, 2007). Thus, the difference in practical relevance poses an additional challenge besides the incommensurability of the two paradigms.

In this paper we try to contribute to a predominant, ongoing paradigm discourse in ISD (rigor vs. relevance, design science vs. behavioral science), which seems to have reached a new climax with the publication of the "Memorandum on design-oriented information systems research" and a "A response to the design-oriented information systems research memorandum" on the EJIS journal website on December 7th of 2010 as an "advance online publication" (Baskerville et al., 2011; Junglas et al., 2011; Österle et al., 2011). Our contribution is based on a model which tries to represent the current situation. Since the field of medicine has faced challenges resulting from the differences between paradigms as well as a lack of focus on practice in the past, we will present and discuss some attempts within ISD to adopt the evidence-based research approach.

In this respect, we provide an analysis of the situation in order to concretely define and conceptualize the aforementioned issues in the following section. Suggestions found within ISD research for the solution of problems identified therein are discussed in section 3. Section 4 then presents the evidence-based approach from medicine and some attempts to adopt this approach to ISD. The fifth and last section summarizes our findings.

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[1] Zelewski (2007) considers the behavioral paradigm dominating Information Systems Research within the Anglo-American domain a quantitative-empirical paradigm since the according methods of research are usually employed therein. Qualitative-empirical methods are less common and gain less attention within the discussion about the paradigms.

[2] The terms are being used as follows. "ISR" is associated with behavioral empirical and mostly quantitative research ("BS"). "BISER" as used within this paper refers to construction-oriented research in accordance with the paradigm of design science ("DS"). This is in order to facilitate the terminology used herein. The fact that a number of researchers have always been working successfully using methodology from the opposite domain (e.g. IS researcher constructing artifacts) will be therefore deliberately neglected. When referring to both terms at the same time, the term IS discipline (ISD) will be used.

2 Issues within the ISR and the BISER Community

Active and continuous exchange between research and practice is crucial to application-oriented disciplines such as ISR and BISER. Ideally, practice impacts research as it raises current issues while researchers address those issues and provide information about solutions science can offer for practical objectives (informs). This mutual exchange is described by Galliers (1995, p. 50) as depicted in figure 1. However, he reminds us that „the model looks simple enough, but we should not be fooled into believing that it represents reality."

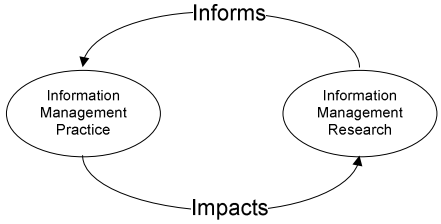

Fig.1. The interdependency of information management research and practice (Galliers, 1995, p. 50).

It will be demonstrated in the following that while Galliers' basic assumption seems still valid 15 years later, a more distinguished approach appears to be appropriate. Therefore, the model will be extended and refined over the course of this section. The extensions and the model's components in the resulting model (figure 2) partly refer to the "Information Systems Research Framework"of Hevner et al. (2004), to make the parallels and development comprehensible. It serves as a conceptualization of the issues raised in this paper.

This discussion refers to the most important common features of the two communities, one of which is the shared subject of information and communication systems (Frank et al., 2008; WKWI 1994), the other one being the fact that both ISR and BISER are applied or application-oriented disciplines (Frank et al., 2008; Österle et al., 2010; WKWI, 1994). They have two basic objectives (Hevner et al., 2004; Phillips, 1998): (1) The *practical objective* is an influence on reality by offering solutions or theory needed for problems encountered in economy and administration. (2) The *theoretical objective* is to describe reality and thus extend the theoretical basis within the discipline. The practical objective has already been addressed in Galliers' (1995) model: practice influences science as it raises practical issues, which are the "business needs" in the framework of Hevner et al. (2004). Researchers develop solutions, which are handed over to practice ("informs").

For a more detailed characterization of the issues, however, it seems that research needs to be distinguished according to the aforementioned paradigms. On the one hand, BISER and ISR differ in respect to the types of results developed and transferred to practice. While ISR/BS research focuses on the development of *theories*, BISER/DS researchers create *IT artifacts*. Accordingly, those are the kinds of results usually offered for the solution of practical problems.

On closer examination, on the other hand, it turns out that BISER and ISR differ as to what extent they are influenced by practice and address practical issues. The potential of a certain discipline to serve a practical purpose can be revealed when examining the extent to which science and practice interact (Schauer, 2010). Moody and Buist (1999), for instance, identify a „disconnect" between the ISR community and practice; the reasons for this are: Firstly, ISR refers to the requirements of publishing outlets rather than practical requirements. Secondly, practitioners are not familiar with academic journals (the „knowledge base" of ISD), which is why research results are hardly applied to practical purposes. Thirdly, experts tend to rely on their own experience or the help of consultants, IT vendors, or other practitioners. According to several authors, practice has little effect on BS research, and practically applicable results are rarely achieved. Conclusively, research results are hardly considered relevant for practice (Agarwal and Lucas, 2005; Gill and Bhattacherjee, 2009). To a lesser extent, this

applies to DS as well (figure 2, interrupted line between DS and practice). DS is generally considered more practically relevant (e.g., Frank et al., 2008). Yet, as Schauer (2010) demonstrates in a recently published interview of BISER professors and CIOs, the relevance of construction-oriented research results is not considered quite unified, which indicates neither a clear discrepancy nor a strong connection between research and practice. Addressing the difference between DS (DS impacts business needs to some extent) and BS (disconnect to practice) research, the first extension of Galliers' model results in the relations illustrated in figure 2.

A second extension to Galliers' model serves to demonstrate that not only information is exchanged between science and practice and that an applied science solves more than some individual practical problems. While this is indicated by his very simplified model, the aforementioned theoretical objective addresses the fact that a pool of knowledge is established within applicable science as a permanent reference. Hevner et al. (2004) refer to this as a „knowledge base" containing „raw material" of the discipline "from and through which IS research is accomplished." Additions are made both by construction-oriented and behavioral research. The knowledge base is a starting point for scientific research and pool of knowledge for practice, as it serves as a mediator between science and practice: "The contributions of behavioral science and design science in IS research are assessed as they are applied to the business need in an appropriate environment and as they add to the content of the knowledge base for further research and practice" (Hevner et al., 2004).

Hevner et al. seem to imply an integrated knowledge base. That is, they do not address the question of whether the existence of different "knowledge bases" should be assumed because of the difference between the research paradigms. However, this seems to be the case considering the differences in respect to methods and result types suggested by Frank et al. (2008) which are also mentioned by Hevner et al. (2004). The creation of one integrated knowledge base is complicated by the incommensurability resulting thereof.

The factor of motivation can be considered as well. Assuming that researchers are mostly loyal to the research tradition of their own community, it can be concluded that they generally intend to contribute to its own "knowledge base".

Another reason for this is the fact those offering research are also the recipients within their respective community (Moody and Buist, 1999). Hirschheim and Klein (2003) identify a lack of communication between individual communities resulting in their potential not being fully realized. While Frank et al. (2008, p. 407) find that the exchange between communities has recently been enhanced, they state that the critical mass which is needed in order to eliminate the "disconnect" has not yet been gathered. Therefore a discrepancy between the two communities has to be assumed. Due to the lack of direct and active exchange between the communities, a common "knowledge base" is only occasionally established. Both empirical studies and comparative studies of IT artifacts beyond mere evaluation are rarely found (Goeken and Patas, 2010, p. 174)[3]. Neither is the process of construction build upon a theoretical foundation as advised by Gehlert et al. (2009). The integration of a knowledge base appears yet to be desirable because it supports decisions concerning construction in DS research, which might enhance the quality of the artifacts created. Also, the way of informing practice about IT artifacts could be facilitated, as could the availability of knowledge, e.g. by offering comparative studies about artifacts.

As a result from the mentioned aspects, the knowledge base is split in two. This forms the second major extension to Galliers' model. To summarize the description of the situation, the following conclusion can be made (referring to figure 2):

[3] This does not refer to attribute-based comparison as regularly achieved in state-of-the-art studies but to studies on the advantages and suitability of the application of IT artifacts within several contexts and situations.

The cycles resulting from – DS Research, Artifact, KB(DS) – (*cycle 3*) respectively – BS Research, theory, KB(BS) – (*cycle 4*) are evident. Acting within their community and in accordance with a paradigm, researchers establish theories or artifacts, thus contributing to an addition to their respective "knowledge base".

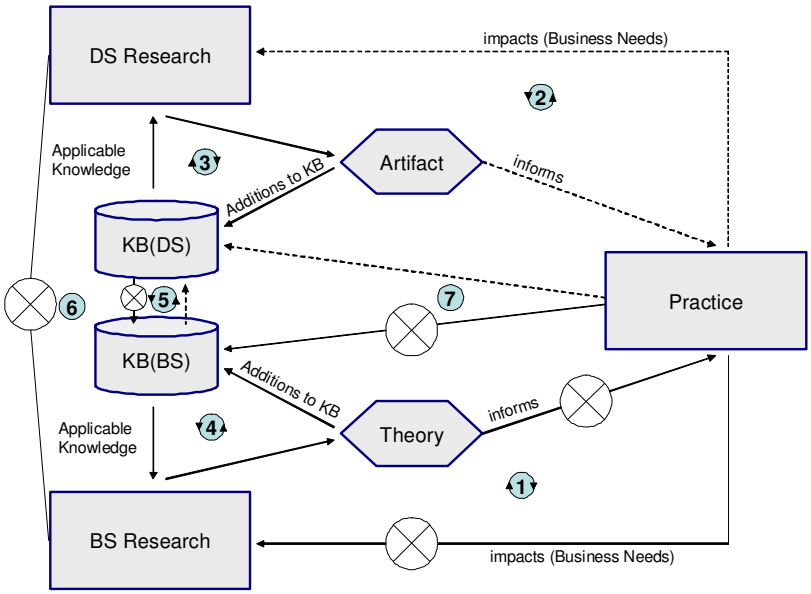

Fig. 2. Concepts of the issues and challenges within information systems discipline.

While overall an exchange with practice is a difficult matter, it differs within the two communities:

- A "disconnect" (crossed-out circle) is attributed to *cycle 1* (BS Research – Theory – Practice) within BS research, both for the adoption of practical issues (impacts) and for the transmission and application of research results. With IS/BS research being considered an applied science, this is an unsatisfactory situation as criticized in the references above.
- While the adoption of practical issues and the transmission/application of results (artifacts) seem to work better within DS research, Schauer (2010) recognizes a potential for improvement (*cycle 2*).

A common knowledge base for both paradigms is not available due to factual (incommensurability) and motivational constraints. However, mutual reference takes place in different ways (*cycle 5*):

- BS research frequently derives its research models from the knowledge base of its own community and thus from behavioral literature. Empirical comparison of competing artifacts play a minor role, as does the examination of artifact-based theories. The "knowledge base" of the DS community is only occasionally referred to.
- DS research has been focused on basing their subject of research on findings from behavioral research, thus constantly establishing and defining their inquiries by means of the empirical works of KB(BS). Also, reference to theories is considered increasingly important as a way of improving the quality of artifacts when making decisions regarding design.

There are separate research communities failing to sufficiently communicate with each other (*disconnect 6*) since a critical mass in mutual exchange has not yet been reached to bridge the gap.

Not recognizing the practical use of theories and lacking structured literature reviews on competing IT artifacts, practitioners hardly refer to the scientifically established knowledge base. This seems to be the case even more within BS/ISR research than within the field of DS/BISER (interrupted line and *disconnect 7*).

With regard to these disconnects and weak connections depicted in figure 2, approaches from ISD research attempting to solve the aforementioned problems will be discussed in the following chapter.

3 Solutions from the ISR and BISER Communities

Since the model presented in section 2 offers a concise analysis of the situation of ISD rather than revealing novel aspects, a number of suggestions on how to deal with the problems and challenges presented can be found in the literature. A number of selected studies and their respective proposals of solutions will be analyzed in the light of the model in figure 2. The studies analyzed herein are Benbasat and Zmud (1999), Hirschheim and Klein (2003), Frank et al. (2008), Rosemann and Vessey (2008), and Gehlert et al. (2009). While the first three of them offer generic proposals for particular problems, both Rosemann and Vessey (2008) and Gehlert et al. (2009) offer concrete instructions. A comparison of the proposals will be given in table 1 in section 3.2.

3.1 Overview of proposals of solution

In their paper on „Empirical Research in Information Systems: The Practice of Relevance“, Benbasat and Zmud (1999) address the reasons for quantitative empirical ISR being considered less relevant for practice. Therein, the studies regarded as relevant for practice are those addressing current topics and practical issues while making proposals of solutions to be implemented. Additionally, studies which categorize, systemize, and consolidate the “body of knowledge (BoK)” or “state of the art in research” within a domain are considered relevant, as are those prompting the reader to critically reflect on factual issues. Benbasat and Zmud (1999) attribute the lack of practical relevance of research within the ISR community to five factors: focus on rigor over relevance, lack of cumulative research tradition, the dynamism of information technology, limited exposure to relevant content, and institutional and political factors. Defining the subject and analysis of their study, they thus basically address cycle 1 and disconnect 7 in figure 2. In order to decrease or eliminate both the disconnects between research and practice and the lack of reference to the “knowledge base”, Benbasat and Zmud (1999) offer a total of nine suggestions sorted into the dimensions *interesting, applicable, current*, and *accessible*. According to them, ISR needs to address practical problems and challenges while offering applicable knowledge and instructions, referring to current information technology dynamism, and after all, be comprehensibly presented. Addressing those dimensions, the recommendations made by Benbasat and Zmud can be referred to when examining the relevance of research results. This can also encourage practice to refer to the “knowledge base” of ISD. However, the recommendations are hardly applicable to particular research tasks since they are generalized but not operationalized.

In their article „Crisis in the IS Field? A Critical Reflection on the State of the Discipline“, Hirscheim and Klein (2003) analyze whether ISR is currently in a crisis while critically reflecting the general state of ISR (i.e. regarding several paradigms). Concluding that the discipline lacks communication, they find “disconnects” in several places, distinguishing internal from external disconnects, i.e. disconnects within ISR as opposed to those of practice. The internal communicative problem is attributed to the historically grounded fragmentation of the ISD. The communities lack mutual discourse due to their different paths of development and resulting tendencies towards different paradigms. The reason for a lack of external communication is the negligence of the requirements of IT management, which are not appropriately addressed: *„We note that a better understanding of the relationship between IS and the senior management of profit and non-profit organizations may take on a larger role than in the past thereby, leading to refocusing research and curricula on methods and contents that cannot easily be outsourced. The solution cannot be more java programming and ERP software skills, but a focus on managerial problems and expectations“ (Hirschheim and Klein, 2003).*

To sum up, the authors address all of the problems and challenges presented in figure 2, however in a rather abstract way. Neither communities nor paradigms are clearly differentiated and the subject of research does not refer to concrete details. Although addressing both the internal and external disconnects of IS, the solutions suggested are limited to internal disconnects: „It seems to us that we must first look at ourselves, i.e., the IS academic community“ (Hirschheim and Klein, 2003).

Hirschheim and Klein (2003) present their suggestions by means of a list of five conclusive „action items" with concrete recommendations. Those actions items are: *Change research priorities*, *develop a discipline wide core BoK, understand our organizational stakeholders, change institutional publication practices*, and *develop knowledge creation and transformation networks (KCTN)*. Furthermore, they suggest that the ISR community should pay closer attention to the generalization of results, i.e., theories applicable to the entire discipline. A common BoK for the entire discipline is meant to be a basis for a consolidation of those results. They thus aim at a mutual cross-reference to the "knowledge base" of other IS communities. Also, the synthesis and diffusion of consolidated knowledge should be paid closer attention to by respective publishing outlets (cycle 5). In order to address the needs of all stakeholders, research should be distinguished into short-term and long-term. The former is supposed to address current practical issues (cycles 1 and 2), the latter to enhance the respective "knowledge base" (cycles 3 and 4). So-called KCTN, an association of various stakeholders, are to be established in order to make research results more comprehensible and acceptable (disconnects 6 and 7). Compared to Benbasat and Zmud (1999), this analysis is considerably broader, but still lacks concrete operational solutions for the instruction of research tasks.

In a comprehensive comparison of the ISR to the BISER community, Frank et al. (2008) draw attention to their differences regarding, for instance, research topics, practical purpose, and methods. Within four categories, they make assumptions regarding these two communities. The categories read as follows: profile and distinctiveness of the communities, relationship to practice (relevance), legitimating the fields as (scientific) research discipline, and coherence of research and teaching. Their work is based on interviews with prominent researchers from both communities. As a result, the authors find an empirically proven „disconnect" between BS and practice. A considerably greater practical relevance, however, can be attested to DS. As a result of their interviews and analysis, Frank et al. find five suggestions which are applicable to the illustration in figure 2. For instance, the horizon of ISR should be broadened instead of being limited to one paradigm. In contrast, the field of BISER should be more clearly focused on how appropriate the applied research methods are. An improved integration of research and teaching is recommended to both parties. While ISR could benefit from a research more strongly associated with DS, doctoral courses within the BISER community should pay closer attention to methodical competence (cycles 3, 4, and 5). By improving their communication, both communities could take advantage from the benefits of the respective opponent while creating a more attractive culture of research (disconnect 6). Moreover, the ISR community could permanently enhance the relevance of their research by closer association with practice whereas BISER should refrain from addressing practical "hypes" (cycles 1 and 2). Meant as mere recommendation, the solution offered does not point towards direct operationalization of their suggestions.

Comparable to Benbasat and Zmud (1999), Rosemann and Vessey (2008) state that research results by the ISR community are hardly practically relevant.[4] Three reasons are given for this. Firstly, there is little motivation for practical research since the dealing with practical issues is hardly appreciated within top journals. Secondly, it is commonly believed that relevance and rigor are contradicting, in fact, diametric. Thirdly, the ISR community thinks that practice is not interested in research results. In order to solve the aforementioned problems and challenges and enhance practical relevance, Rosemann and Vessey (2008) develop a so-called „Applicability Check" which, referring to the nominal group technique, evaluates the relevance and applicability of both new and existing research results. Practitioners are involved in order to provide for the best possible practical relevance. Rosemann and Vessey thus offer a concrete method enhancing the practical relevance of research without affecting the actual research process. Therefore, the practical use of results can be examined before they are published. Alternatively, evaluation can take place either in between research cycles or

[4] Not restricted to the behavioral research paradigm, Rosemann and Vessey (2008, p. 2) partly include construction-oriented research: „… theories, models, frameworks, processes, technical artifacts or other theoretically based IS artifacts that academic community either uses or produces in its research."

after results are published. Addressing cycles 1 and 2 in figure 2, they thus give concrete advice on how to enhance the practical relevance of research in ISD in general.

In their equally concrete and thus applicable approach, Gehlert at al. (2009) suggest constructs necessary for the instruction of the process of artifact construction by means of theories. They thus address the question of how construction-oriented research can benefit from the knowledge base of BS (cycle 5). They argue that the respective researcher should refer to theories during the process of construction, firstly in order to increase the intersubjectivity of the artifact and secondly to enhance the quality of the constructed artifact during the research process. They suggest that the objective of the research process should be named in actual requirements, which should be operationalized by means of indicators. This should be done in order to make decisions on design more easily comprehensible and in order to facilitate the evaluation of artifacts. The application of this approach is supposed to make the process of construction more transparent. It is thus demonstrated how theoretical results from the "knowledge base" of BS research can be used with the field of DS research. Also, the authors show how theories from BS research can be more effectively used within the process of construction in DS research. The guidelines by Hevner et al. (2004) are referred to as well, their objective being to enhance the creation of artifacts and thus basically addressing cycle 3. Cycle 2 is addressed as well as both the relevance with respect to the problem and communication with practice is included, albeit to a lesser extent.

3.2 Discussion

As exemplified in table 1, literature in this research domain hardly offers approaches which fully address the entirety of the challenges and problems presented above, nor the question of how to enhance the weak connections and eliminate the disconnects. Summarizing the proposed solutions previously discussed, it turns out that some of them can complement each other: Benbasat and Zmud (1999) name requirements to enhance the practical relevance of BS research. The approach by Rosemann and Vessey can be considered for operationalization and concretization. The frequently quoted guidelines by Hevner et al., in contrast to Benbasat and Zmud, name requirements enhancing the scientific rigor within DS research. Again, the approach by Rosemann and Vessey can be considered for operationalization and concretization herein. Focusing on a specific aspect (guideline 5 in Hevner et al., 2004), Gehlert et al. (2009) propose a methodical framework to meet these requirements. Hirschheim and Klein (2003) cover the largest part of the aforementioned problems. However, they state that the approaches are aimed at internal disconnects only while partly addressing practical relevance. The very abstract discussion therefore concludes with few directly applicable and proven solutions, which is why they are considered generic. The complexity and the wide range of the analysis of the problems and challenges depicted in figure 2 results in concrete and directly applicable solutions addressing only a certain number of aspects.

	Generic proposals of solutions			Concrete proposals of solutions		
Location in figure 2	Benbasat and Zmud 1999	Hirschheim and Klein 2003	Frank et al. (2008)	Rosemann and Vessey (2008)	Gehlert et al. (2009)	Hevner et al. (2004)
Cycle 1	●	●	●	●		
Cycle 2		●	●	●		●
Cycle 3		●	●			●
Cycle 4		●	●			
Cycle 5		●	●		●	
Disconnect 6		●	●			
Disconnect 7	●	●				

Table 1. Proposals addressing the problems and challenges of the information systems disciplines.

Hirschheim and Klein as well as Frank et al. name „action items“, or „propositions“. Their choice of terms suggests that these are meant as generic suggestions with regard to research politics rather than concrete applicable research methods. For example, they claim that horizons should be broadened beyond the respective discipline and that priorities in research should be reconsidered, as should the ways of evaluation and publication. Both of them address institutional aspects in more detail as they suggest options of improving teaching and doctoral courses and the establishment of centers for competence. For instance, Hirschheim and Klein recommend KCTN as „a new way to disseminate the results of our research, thereby helping to address the field's communication deficit.“ Moreover, Hirschheim and Klein and Frank et al. consider the improvement of communication between disciplines desirable. Although desirable, increased communication will be difficult to accomplish if rationally performing entities are assumed to maximize utility. The aforementioned motivational factors (section 2) imply that beneficial communication or mutual exchange will not be accomplished in near future, as do factual aspects such as incommensurability. A discipline wide body of knowledge as suggested by Hirschheim and Klein might be a promising approach: "Focus on the viability of a discipline wide core BoK that is not legislated but emerges from consensual negotiation.“ Similarly, Benbasat and Zmud (1999) regard the studies which classify, categorize, and consolidate the BoK or research as relevant. Thus, the idea of an integrated knowledge base (figure 2) contributing to the solution of the initial problems discussed herein is supported, both in respect to the elimination of "disconnects" between paradigms and to the improved support of practice by research.

For instance, information about IT artifacts for the solution of problems could be made available for practical purpose and access to knowledge thereof could be facilitated if comparative studies addressed and offered this knowledge in introductory articles.[5] Gehlert et al. (2009) claim, that the process of construction should itself be guided by theories. Similarly, Gregor (2006) names one out of five possible theories the "Theory for Design and Action“. In fact, reference to theories seems desirable as it makes decisions on construction within DS research more plausible, which might enhance the quality of constructed artifacts considerably. The advantage of basing the construction of IT artifacts on theory is that the amount of iteration passed during construction can be decreased. Also, it has been stressed during the past years that theories from DS research represent important output of DS research (Nunamaker et al. 1991; Walls et al., 1992). Those design theories can then refine the theories of behavioral research (Kuechler and Vaishnavi, 2008).

4 The Evidence-based Method: A Possible Solution?

Interestingly enough, the field of medicine faced similar challenges during the 1990s, that is, the challenge of examining procedures and the large body of (practical) knowledge more strictly and justifying clinical decisions. As a result, EbM was developed as a means of improving knowledge as well as knowledge use. This is done by "conscientious, explicit, and judicious use of current best evidence in making decisions" (Sackett et al., 1996). According to many authors, EbM achieved both an improvement of the daily practice and makes "medicine more scientific" (Hiatt and Goldmann, 1994; Rosenberg and Donald, 1995). The evidence-based method achieved that individual experience, physician's authority, deduction, or biological plausibility no longer determines the state-of-the-art exclusively and critical appraisals of empirical evidence from scientific studies guide medical practice (Raspe, 1996, p. 560). A major goal is to help practitioners to base their decisions and actions on the best possible evidence, including external clinical evidence from systematic research (Sackett, 1996), which seems desirable for an applied discipline. These basic ideas and assumptions have been transferred to the domain of information systems before, but, to the best of our knowledge, usually only parts have been adopted.

[5] Considering this, the large amount of overviews and its major role within the BISER community can be regarded as very positive (Fettke 2006).

Moody and Buist (1999), for instance, refer particularly to the role model in order to demonstrate parallels. From an institutional perspective they propose a collaborative model for improving the links between research and practice but they do not discuss different paradigms in the ISD. Hence they solely focus on the theory/practice divide and only on institutional mechanisms to improve the situation in the discipline. Fettke (2008) adopts the "levels of evidence" ranking of EbM in order to appraise studies depending on their research design. One basic assumption in EbM is that some research designs provide a stronger level of evidence than others (e.g. because randomized controlled trials are more representative than case studies). Dybå et al. (2005) like Moody and Buist (2000) focus on closing the gap between research and practice in their EBSE approach (Evidence-based Software Engineering). Their intention is to assist a software engineer in the procedure of searching, appraising and applying empirical evidence. Davis and Hickey (2004) examine requirements engineering research conducting a meta-study and hereby adopt "many of the medical research practices to the RE world". Furthermore they provide guidance for the combination of different research approaches. Goeken and Patas (2010) combine two related aspects. On the one hand, they focus on the intersection of practice and science. On the other hand, they refer to the interplay of different research methods. In medicine, the advancements were achieved by improving the collaboration of biological research, static-epidemiological research (empirical studies), and presenting evidence ready for use in the day to day medical practice. This collaboration can particularly be applied to figure 2. While biological research develops new methods and medication (i.e. carries out construction-oriented research producing 'medical artifacts') and evaluates them, static-epidemiological research focuses on the examination of the effects of methods and medication in empirical studies. Thus, EbM appears as a method of increasing knowledge by means of clearly defined criteria for the evaluation of scientific studies and their synthesis (epistemological perspective). From this perspective, it is crucial to consolidate the empirical evidence of several evaluations and other meta-studies.

Critical for the success of evidence-based research is the existence of functional and technical infrastructures which allow for structuring of results of existing studies and efficiently and effectively supporting the search for relevant evidence (Raspe, 1996, p. 558). Structuring relevant knowledge can be interpreted as the development of an integrated knowledge base which contains theories and empirical evidence, originating from BS research. Evidence-based research in ISD means to structure, classify, evaluate and represent it in a way that it is usable for practitioners and/or DS researchers. Because it can be assumed that practitioners are often unable to analyze empirical studies, structuring, classifying and representing this knowledge might be one important goal of an applied discipline. It has been attempted in Goeken and Patas (2010) to deduct a specialized infrastructure by means of a conceptual metamodel for requirements engineering and to make it available with reference to the empirical results in this field. According to the model presented above, this suggestion aims at creating an integrated knowledge base enabling and presenting the classification of empirical evidence for research purposes while supporting system developers, who can search for empirical evidence within particular topics (e.g. which techniques of requirements engineering have empirical evidence and which context has been addressed within the studies). The basic principle as well as the methods of consolidation and evaluation of empirical research seems suitable when systemizing existing evidence within the field of ISD, thus improving both the integration of existing knowledge (independent of the research paradigm) and the availability of relevant knowledge for practical purposes.

5 Summary, Limitations, and Conclusion

It has been attempted in this paper to depict an analysis of the situation for the ISD and to define and conceptualize some basic problems and challenges. The incommensurability of the paradigms, a lack of practical orientation, and a lack of integration of the respective "knowledge bases" have been identified as problems. Suggestions from the field of BISER and ISR have been referred to in order to describe possible solutions for those issues. The discussion in section 2 was based on a model. Like any model, this does not purport to provide an exhaustive picture of reality, but an abstraction of it.

We have to consider some limitations which indicate the need for future research: Even though the model presented might be plausible and coherent with respect to seminal papers like Hevner et al. (2004), it is not yet evaluated. The rating of the strength of the different linkages was supported by positions and arguments taken from literature. Future research is needed to gather more evidence regarding these linkages. Nonetheless it can give a structure to the "methodological divide" encountered in ISD. In the presented version the model is narrowed down to the main paradigms DS and BS, which are dominant in the ISD and thus in the focus of the current debate. Consequently it suppresses other important research streams and scientific work carried out in parts of the discipline, e.g. qualitative research methods like action research, case studies and grounded theory. As qualitative research methods can be used in the research process at least for both, building theory and testing/evaluating theory (and artifacts), their integration would be a major extension of the first version offered here, which will be subject to future research.

In the current version of the model, practice does not have a knowledge base, even though the authors agree that "the body of knowledge of design-oriented IS research is constituted by the experiences and knowledge accumulated in business concerning IS, software products, organizational concepts, methods, and tools." (Österle et al. 2010 p. 2). There are best practice models as well as reference models which are of interest for practitioners and researchers alike. In future versions of the model the integration of the knowledge base of practice will allow a better approximation to reality and will – furthermore – allow a more sophisticated discussion of the practice orientation.

EbM has been referred to as a solution from another scientific discipline which has successfully contributed to the improvement of a comparable situation. Therefore, and because a number of similarities can be found between the issues addressed in this paper and the discipline of medicine, it is assumed that ISD can benefit from an evidence-based approach as the problems addressed herein can similarly be alleviated. However, it must be taken into account that the similarities are limited since medicine is a natural science which frequently draws from a large statistical population whereas most issues in ISD typically depend to a great extent on socio-cultural influence of variables, that is, studies can hardly ever be standardized and draw from a statistical population. Prospective research will discuss the concept of evidence-based research in the field of ISD in greater detail, establishing both fundamentals and methods supporting the process of evidence-based research.

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