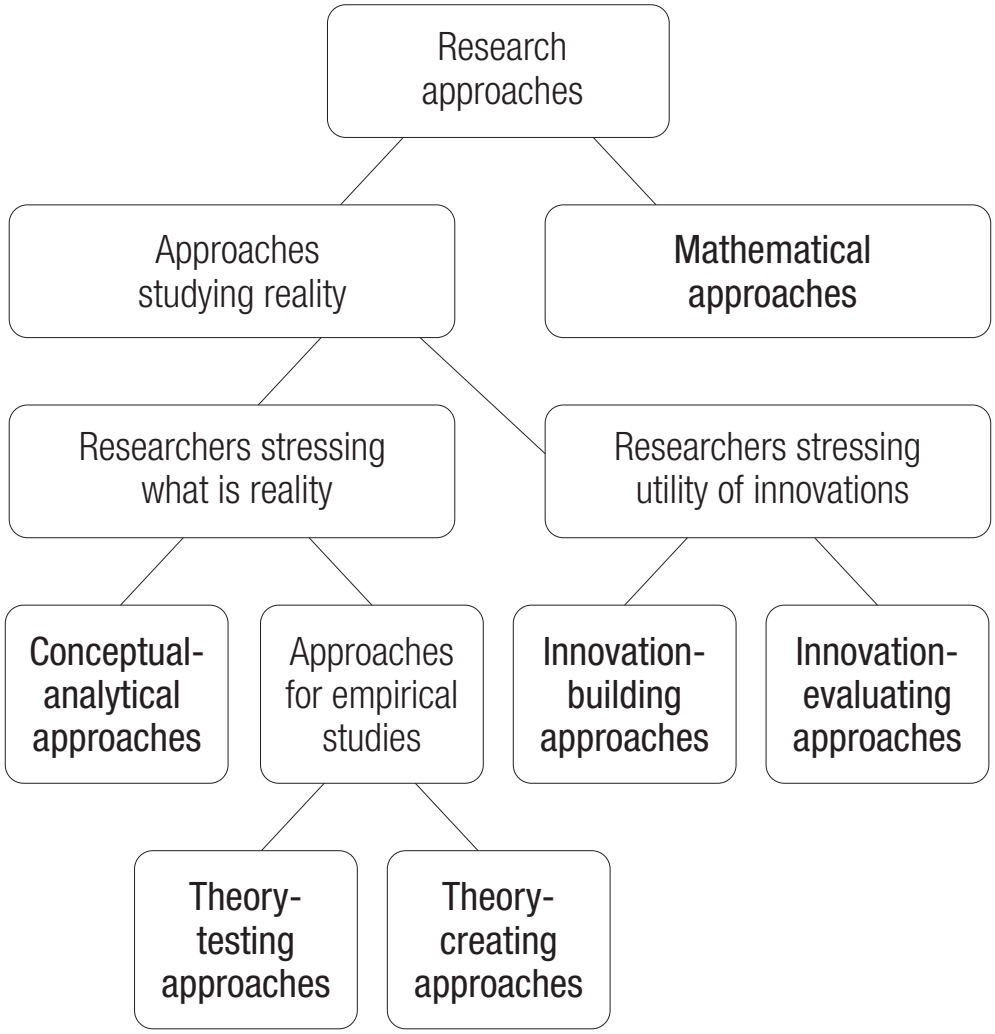
Pertti Järvinen



A taxonomy of research methods

ON RESEARCH WORK IN INFORMATION SYSTEMS

Guidelines, recommendations and examples

Pertti Järvinen

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JYVÄSKYLÄ 2021

Permanent link to this publication: http://urn.fi/URN:ISBN:978-951-39-8508-0

ISBN 978-951-39-8508-0 (PDF)
URN:ISBN:978-951-39-8508-0
ISSN 2489-9003 Jyväskylä University Printing House, Jyväskylä 2021

ABSTRACT

Järvinen Pertti
On research work in information systems: Guidelines, recommendations and examples
Jyväskylä: University of Jyväskylä, 2020, 189 p.

ISBN 978-951-39-8508-0

The most positive aspect of science is that the participants (researchers, reviewers and editors) control and evaluate their work themselves. Therefore they must be supported in one way or another. Fortunately, guidelines have been developed for different methodologies. However, today the guidelines are not very applicable. The first two sets of guidelines published (both positivist studies) had unusual problems. In this work, we analyze and improve the guidelines generally. Previously, selecting a methodology was the task of every researcher. It now seems that every researcher must also conduct a literature review and write a report. We consider methodology, literature review and writing "synchronously". To this end, we examine the guidelines for methodologies and develop guidelines for literature reviews and writing. Guidelines are understood pedagogically, for example, as checklists. We also review new articles and spot-check whether the authors used guidelines, guidance for literature review and for writing or not, which type of deficiencies in these articles we find and how we could improve the articles. We present results already in Chapters 2, ... 4 and in their sections, say "logally", and in Chapter 5, globally, i. e., implications for theory and practice, some limitations and directions for future research.

Keywords: guideline, literature review, writing, methodology, recommendation

TIIVISTELMÄ

Järvinen, Pertti
Ohjeita, suosituksia ja esimerkkejä informaatiosysteemien tutkimukseen
Jyväskylä: University of Jyväskylä, 2020, 189 s.

ISBN 978-951-39-8508-0

Tieteen piirissä on päätetty, että tieteentekijät (tutkijat, toimittajat ja arvioijat) itse arvioivat ja valvovat toistensa työtä. Tämä on hieno, positiivinen ja vastuullinen valinta. Tällaista arviointia ja valvontaa tulee tukea eri tavoin. Siihen tarkoitukseen on kehitetty ohjeita eri metodologioihin jaoteltuna. Ohjeita ei kuitenkaan aina ole noudatettu. Harmillisesti kaksi vanhinta ohjejoukkoa on ollut sellaisessa muodossa, että niitä on ollut vaikea soveltaa. Lisäksi ne ohjejoukot ovat koskeneet keskeisiä tähän asti käytettyjä tutkimuksen lähestymistapoja. Tässä tutkimuksessa haluamme analysoida ja parantaa mahdollisimman monia ohjejoukkoja. Kunkin tutkijan on valittava oman tutkimuksensa metodologia ja samalla siihen liitetyt ohjeet. Lisäksi näyttää, että tutkijan on lähes aina tehtävä kirjallisuuskatsaus ja osattava kirjoittaa tutkimuksestaan. Siksi tarkastelemme tässä, miten tutkija on käyttänyt metodologian, kirjallisuuskatsauksen ja kirjoittamisen ohjeita työssään. Sen vuoksi arvioimme eri metodologioiden ohjeita ja pyrimme kehittämään kirjallisuuskatsauksen ja kirjoittamisen ohjeita. Haluamme, että ohjeet ymmärretään pedagogisesti, vaikkapa tarkistuslistoina. Arvioimme muutaman "satunnaisesti" valitun artikkelin ja tarkastamme, ovatko tutkijat noudattaneet metodologian, kirjallisuuskatsauksen ja kirjoittamisen ohjeita, sekä onko tarkasteltavissa artikkeleissa muita puutteita. Esitämme mahdollisuuksien mukaan parannusehdotuksia. Luvuissa 2, ..., 4 esitämme tuloksia aina käsiteltävän asian yhteydessä. Luvussa 5 keräämme tuloksemme ja arvioimme, miten ne vaikuttavat tähänastiseen teoreettiseen kirjallisuuteen, käytäntöön, ja mitä rajoituksia tarkasteluumme sisältyy, sekä mitä uusia tutkimushaasteita on tullut esille.

Asiasanat: ohje, kirjallisuuskatsaus, kirjoittaminen, metodologia, suositus

ESIPUHE

Kiitän Jyväskylän yliopiston Tietotekniikan tiedekunnan ja Kirjaston henkilökuntaa tuesta ja avusta. Erityisesti haluan mainita prof. Mikko Siposen, joka on jaksanut ohjata tätä työtä.

Olen kiitollinen perheelleni rohkaisusta, keskusteluista ja avusta. PhD Raimo Hälinen on antanut arvokkaita neuvoja.

Tampere 21.1.2021

Pertti Järvinen

FIGURES

TABLES

CONTENTS

1 INTRODUCTION

In this report, we try to help information systems (IS) researchers when they are conducting and writing their studies, and the reviewers and editors when they are evaluating the submissions by presenting some guidelines. Two processes, submitting and rewiewing, are characterized with some models. We also like to emphasize that that goals of studies can be divided to two groups: studies stressing 1) what is a part of reality (truth) and 2) what is a utility of a new system. An example of the former is the Jenkins' (1985) method of the research project. Jenkins' method contains eight sequential steps: 1. idea, 2. library research, 3. research topic, 4. research strategy, 5. experimental design, 6. data capture, 7. data analysis and 8. publish results. Jenkins says that this kind of method is over-simplification, because a research process often is iterative. The Jenkins method is an example of the so called phase methods for studies stressing what is a part of reality. As an example of the latter (constructing a new system), Peffers et al. (2007) propose a 6 phases method (1. Problem identification and motivation, 2. Define the objectives for a solution, 3. Design and development, 4. Demonstration, 5. Evaluation and 6. Communication) for studies stressing utility of a new system. For both types of studies there are also methods including a cycle, e.g., for canonical action research (CAR) (see Section 2.5 Davison et al. (2004).

A reviewing process for a submission can be described with sequential phases: 1. submitting, 2. reviewing, 3. accepting or correcting and re-submitting, 4. re-reviewing, 5. accepting or rejecting. A researcher can submit and once correct a draft of a study. Normally, there are two to three reviewers and an editor, a superior of reviewers. It is sometimes allowed that there is more than one correction step.

During the covid-19 pandemia a certain medicine for HIV (human immunodeficiency virus) were given to corona patients without analysis and evaluation of physicians' pre-control, i.e., without a peer referee procedure. Some weeks later, doctors state that this medicine will not help a corona patient. This demonstrates that a pre-control of medicines is needed. A situation is similar in

connection with scientific reports, i.e., a submission of a research report needs a pre-control procedure.

In this and some following paragraphs we like to present some *boundaries* of our consideration. Straub et al. (1994, p. 22) have shown that in some journals, e.g. in *Manegement Information Systems Quarterly* (*MISQ*), there is a set of standards / guidelines (Relevance, Objectives, Readability, Organization, Literature review, Methodology, Quality of evidence, Contribution, Potential contribution) how to write a scientific article (see Table 3 later). Many journals, e.g., *European Journal of Information Systems* (*EJIS*) have limited a domain, from where it likes to get submissons. - Most method books are concentrated on one method only.

In journals, there are also a division of studies whether they accept studies with empirical data only or do they also approve non-data studies. For example, Liu and Myers (2011) found that Ives, Hamilton and Davis (1980) had 30 % non-data studies, Chen and Hirschheim (2004) 60 %empirical studies and 40% non-empicial ones , and they themselves 60-70 % empirical, 20-40 % non-empirical yearly. This study can be classified as non-empirical and ex ante one.

Iivari was worried about the reviewers' approval. He saw that:

> Scholarly or scientific peer review is the evaluation of research findings for competence, significance and originality by qualified experts who do research in the same field (Brown, 2004; Benos et al., 2007). Peer review is critical in the process of legitimizing new scientific knowledge and assuring its quality. A piece of research that has not passed scholarly review and has not been published cannot be regarded as scientific since its findings have not been accepted by the scientific community in question and are not trustworthy in that sense. (Iivari 2016a, p. 264)

Iivari prepared three technology-independent system-level means for improving the quality of the review:

> 1) provide systematic feedback to reviewers, 2) reward good reviews, and 3) make reviewers more accountable by revealing their identity to authors in certain conditions. (Iivari 2016a, p. 264)

This manuscript (Iivari 2016a) was solicited by the (*Communications of the Association for Information Systems*, [*CAIS*] Department Editor for Debates, Karl Heinz Kautz. He asked six distinguished IS researchers (Jennex, Mora, Ralph, Recker, Saunders and Stafford) to comment on Iivari's suggestions. Ralph clearly opposed; the others supported the author slightly. Iivari (2016b) replied nicely to the six experts. In this work, however, we consider these kinds of system-level problems beyond the scope of our topic.

There are differing, perphaps opposite opinions on what a certain journal likes to publish. For example, Colquitt and Zapata-Phelan consider that

> Replications of previously published work and very incremental research rarely offer enough of a contribution to warrant publication. (Colquitt and Zapata-Phelan 2007, p. 1303)

Their journal was *Academy of Management Journal* (*AMJ*). In addition, Rai, editor-in-chief of *MISQ* wrote:

> No prizes are awarded for being second to discover a scientific law. (Rai 2017, p. vi)

However, Siponen and Klaavuniemi (2019) showed that, for example, the development of several famous theories took a very long time and advancement has taken place gradually.

The opposite of the proposal above: "The same result does not occur twice" exists, when Berthon et al. states:

> Research is a methodic search for knowledge: an epistemological process. Just as epistemology presumes methodology, methodology presumes replicability. (Berthon et al. 2002, p. 416)

The authors define that

> Replication is the process of going back, or "re-searching" an observation, investigation, or experimentation to compare findings.

Straub et al. (1994) contend that

> manuscript quality can be improved by making explicit, to authors and reviewers alike, the standards [guidelines] that are being used when manuscripts are rejected or accepted. (Straub et al. 1994, p. 22)

They found

> key criteria and normative standards [guidelines] for publishing research are differentiated by research methodology. (Straub et al. 1994, p. 22)

Straub et al. use the term "standard" and other writers the term "guideline". The two terms mean the similar thing. - Holtkamp et al. (2019) evaluated guidelines for interpretive, design science and mixed methods research, and concluded that guidelines are not evidence of cause and effect or good outcomes. To our mind, however, following guidelines can improve research methodology, when an object domain is useful.

By referring to an importance of methodology (Straub et al. 1994) in studies, we can now state our *research questions*:

a) What are guidelines presented in the IS literature, their advantages and weaknesses for most methdologies?;

b) how are those methodologies related to a structure of research methods?

Every research report must be published, and hence, we ask:

c) Are guides to write a report good enough?

Many researchers are performing a literature review (LR) in order to find a gap, and stating a problem formulation on this gap. Thus, we can ask:

d) Are in a literature some guidelines for LR, can we classify LRs in one way or other, and can we find a gap in a new way, too?

We like to spot-check:
e) Are guidelines and some known LR methods used in recent articles?

We exclude evaluation of writing in spot-checking, because the articles read often are well-written.
Next, we like to present some arguments for this outlet. First, if a distinguished researcher would asked to evaluate this work as a reviewer or editor. When this work contains many articles in Chapters 2, 3 and 4, we can imagine, that s/he can have difficulties to evaluate his/her 'own' article. The term 'own' can be based on a situation where this reviewer or editor was published or earlier reviewed the paper in those chapters. Then, a violation of neutrality is entangered. We like to avoid this situation.

Secondly, an editor (editor-in-chief, associate editor) or other distinguised researcher could be an author candidate, but s/he could publish this work as editorial rather than a traditional article. A text of an article can easily be too long as an article, when it is here analyzed many different methodologies and their guidelines, many methods for LRs. Our results are tested with some new articles. Therefor, this work is published as a book.
Next, we like to preliminarily *inform* a reader about our *results*:

We shall collect all the methodologies where are published guidelines. Emphasizing an importance of guidelines for research work we evaluate and comment their content. We shall also propose some reduction and advancement for a certain methodology's guidelines. - The similar evaluation and commenting is applied to guidelines, how to write a scientific article.

A set of methodologies elaborated will be related to our set of research methods. Reasons for similarity and for diffrence are then discussed.

In a certain study, we must clarify: what we know and what do not know. Therefore, we must conduct a literature review (LR) and find a gap. We try to find some suitable LR method, and evaluate some classifications of many different type of LRs.

In Chapter 2 and 3 , we have shown an importance of methodology and LR. In Chapter 4, we shall analyze: 1) which type of methodology and LR are carried out, and how they are used in some new articles.
The rest of this work is structured as follows: In Chapter 2, we evaluate traditional guidelines for different methodologies and consider guidance for writing. In Chapter 3, new guidelines for literature reviews are suggested. In Chapter 4, we review selected new articles and examine how they utilized several conventional, traditional or old guidelines. Finally, we collect many of the findings to make recommendations. We also evaluate limitations of our study and suggest how to alleviate them in future studies.

2 TRADITIONAL GUIDELINES FOR METHODOLOGIES

In this chapter, we analyze traditional guidelines for different research methodologies and try to improve the guidelines. We found guidelines for case studies (Benbasat et al. 1987), positivist studies (Straub et al. 1994), interpretive field studies (Klein and Myers 1999), design science (Hevner et al. 2004), canonical action research (Davison et al. 2004, 2012), conceptual studies (Hirschheim 2008), grounded theory studies (Urquart et al. (2010), critical studies (Myers and Klein 2011), and mixed methods studies (Venkatesh et al. 2013, 2016). By showing, evaluating and perhaps improving guidelines, it is intended to help researchers in their studies and support reviewers in their evaluation task.

The examination of guidelines is structured chronologically. We consider different methodologies in Sections 2.1—2.9. In each section, we present one important article, that is, a reader can see the section titles of the original articles and thus, follow the authors' process. At the end of the article, we present our review of the article(s). We summarize our consideration in Section 2.10. Some methodologies, such as positivist, design and conceptual, contain guidance for presentation, but others do not. Therefore, in Section 2.11, we consider writing for all kinds of methodologies.

Every researcher must select the research methodology suitable for her research task. Most of the researchers that we cite are (or have been) editors of a certain journal, and they are worried about the quality of the submissions the journal received. The researchers wrote guidelines for a particular methodology to improve submissions. We refer to Holtkamp et al. (2019) who emphasized that a researcher, however, cannot demand that her submission be published in a certain journal, although the submission follows the journal's guidelines. Holtkamp et al. also advised reviewers and editors that they cannot reject a submission on the grounds that the submission did not follow the journal's guidelines.

2.1 Positivist case studies

In the IS domain, it is, and has been typical, that technology continually advances. Then, theory and practice prefer that it is soon sought new knowledge concerning a novel technology. A study can then refer to several first implementations of a new technology. It is more suitable and faster to use a case study approach than a survey, for the latter may need more IT implementations. This might be a reason why guidelines for case studies were first stated. Benbasat, Goldstein and Mead (1987) wanted to help researchers by presenting guidelines for how to conduct case study research and publish it. Later, Eisenhardt (1989) proposed eight steps for case studies. We present Benbasat et al. (1987) first and then Eisenhardt (1989).

Benbasat et al. (1987)

Introduction

Benbasat, Goldstein and Mead motivate that:

> There has been a growing interest in the use of qualitative techniques in the administrative sciences. ... Similarly, in the information systems (IS) field, Franz and Robey (1984) have suggested the use of idiographic rather than nomothetic research strategies. Idiographic research attempts to understand a phenomenon in its context. In such research, the investigator intensely examines as single entity or a particular event. Nomothetic methods, on the other hand, seek general laws and draw solely on procedures used in the exact sciences (Weick 1984). (Benbasat et al. 1987, p. 369)

Siponen and Klaavuniemi claim that:

> No such laws exist in IS. (Siponen and Klaavuniemi 2019, p. 6)

Generally, they elaborate that in the sciences there is no discipline (not even physics) that should have nomothetic laws only.

According to Benbasat et al.,

> three reasons why case study research is a viable information systems research strategy. First, the researcher can study information systems in a natural setting, learn about the state of the art, and generate theories from practice. Second, the case method allows the researcher to answer "how" and "why" questions, that is, to understand the nature and complexity of the processes taking place. Questions such as, "How does a manager effectively introduce new information technologies?" are critical ones for researchers to pursue. Third, a case approach is an appropriate way to research an area in which few previous studies have been carried out. With the rapid pace of change in the information systems field, many new topics emerge each year for which valuable insights can be gained through the use of case research. (Benbasat et al. 1987, p. 370)

Case research is a sensitive method where a researcher is closely making observations at the site, and she can (supposing that she understands the topic under study) discover how and why something happened. Otherwise, (without direct observation) it can be more difficult, and even impossible.

Case Research: Definition

Benbasat et al. define case study as follows:

> A case study examines a phenomenon in its natural setting, employing multiple methods of data collection to gather information from one or a few entities (people, groups, or organizations). The boundaries of the phenomenon are not clearly evident at the outset of the research and no experimental control or manipulation is used. Table 1 [Table 1] contains a list of eleven characteristics of case studies summarized from the papers mentioned above. (Benbasat et al. 1987, p. 370)

Table 1 Key characteristics of case studies (Benbasat et al. 1987, p. 371)

1.	Phenomenon is examined in a natural setting.
2.	Data are collected by multiple means.
3.	One or few entities (person, group, or organization) are examined.
4.	The complexity of the unit is studied intensively.
5.	Case studies are more suitable for the exploration, classification and hypothesis development stages of the knowledge building process; the investigator should have a receptive attitude towards exploration.
6.	No experimental controls or manipulation are involved.
7.	The investigator may not specify the set of independent and dependent variables in advance.
8.	The results derived depend heavily on the integrative powers of the investigator.
9.	Changes in site selection and data collection methods could take place as the investigator develops new hypotheses.
10.	Case research is useful in the study of "why" and "how" questions because these deal with operational links to be traced over time rather than with frequency or incidence.
11.	The focus is on contemporary events.

The authors inform the reader how the case study method differs from laboratory and field experiments, and field study:

> A fundamental difference between case studies and these alternative methods is that the case study researcher may have less a priori knowledge of what the variables of interest will be and how they will be measured. (Benbasat et al. 1987, p. 370)

Later in this section, Eisenhardt (1989) requires that "neither theory nor hypotheses", i.e., a researcher does not have *a priori* knowledge. In the literature survey, Benbasat et al. (1987) found three categories of case studies but did not accept 1) application descriptions and 2) action research case studies. According to Benbasat et al. (1987), 1) the author does not conduct a research study; instead, the objective is to successfully implement a specific system for a given assignment under "application development"; 2) The action researcher is not an independent observer, but becomes a participant, and the process of change becomes the subject of the research.

Conducting Case Research

Benbasat et al. evaluate that

> Case methodology is clearly useful when a natural setting or a focus on contemporary events is needed. Similarly, research phenomenon not supported by a strong theoretical base may be fruitfully pursued through case research. A rich natural setting can be fertile ground for generating theories. Conversely, when subjects or events must be controlled or manipulated in the course of a research project, the case approach is not suitable. (Benbasat et al. 1987, p. 372)

The authors present that a case approach is suitable for exploration, hypothesis generation and hypothesis testing. They also recommend that:

> Prior to searching for sites, the researcher should determine the unit of analysis most appropriate for the project. Will the study focus on individuals, groups (e.g., a task force, profit center, IS group) or an entire organization? Alternatively, the unit of analysis may be a specific project or decision. In making this determination, the researcher should closely examine the research questions to be pursued. (Benbasat et al. 1987, p. 372)

Benbasat et al. propose that:

> Central to case research design is the decision to include one or several cases in the project. Most research efforts require multiple cases, but single cases are useful in specific instances. Yin suggests single-case studies are appropriate if:
> 1) It is a revelatory case, i.e., it is a situation previously inaccessible to scientific investigation.
> 2) It represents a critical case for testing a well-formulated theory.
> 3) It is an extreme or unique case. (Benbasat et al. 1987, p. 373)

In a footnote for alternative 2) is the following:

> According to Yin [56, p. 42] To confirm challenge or extend a theory, there may exist a single case, meeting all the conditions for testing the theory. (Benbasat et al. 1987, p. 373)

The authors state that:

> The factors that dictate a single-case design also determine site selection. When multiple cases are to be included in a study, however, choices must be made. It is quite useful to consider a multiple-case project as analogous to the replication that is possible with multiple traditional experiments (Hersen and Barlow 1976). (Benbasat et al. 1987, p. 373)

Negotiations with authority of the site owners are a social event where a firm must require confidentiality and evaluate its benefits from a study.

Benbasat et al. (1987) present as many sources of data as possible (documentation, archival records, interviews, direct observation and physical artifacts). However, based on our experience, most case studies still report that only interviews were used. Collecting data about the same things from different sources provides the possibility for triangulation and thus, forms a firmer base for data analysis.

A Critique of Case-Based Research

The authors surveyed the following journals and conferences between 1981 and 1985 (p. 375): *Communications for the ACM*, the *Proceedings of the International Conference on Information Systems*, *Information and Management*, *MIS Quarterly*, and *Systems, Objectives, Solutions*. (The list gives a historical image of

publishing outlets.) The last journal contained about 25 % case studies, the others 10 % only.

Benbasat et al. analyzed articles by Markus (1981), Dutton (1981), Pyburn (1983) and Olson (1981) more deeply and conclude:

> The characteristics of the four case studies discussed well present the all other case studies, too. (Benbasat et al. 1987, p. 378)

In the latter part of this section, Benbasat et al. (1987) describe the nature and general quality of case studies in IS. The evaluation is based on their guidelines for conducting case research. Unfortunately, the authors never describe their guidelines. Therefore, we bypass this part of section.

Concluding Comments

Benbasat et al. conclude that:

> The case research strategy has mostly been used for exploration and hypothesis generation. This is a legitimate way of adding to the body of knowledge in the IS field. (Benbasat et al. 1987, p. 387)

Review of Benbasat et al. (1987)

The term "guideline" is not in the title, in the abstract nor in a text.

Eisenhardt presents eight steps for case study. She nicely supplements Benbasat et al. (1987).

Eisenhardt (1989)

In the abstract of the article, Eisenhardt (1989) describes "the process of inducting theory using case studies - from specifying the research questions to reaching closure". According to Eisenhardt (1989), process process features, for example "defining the problem and validating the construct", are rather similar to what is known as hypothesis-testing research. Eisenhardt (1989) maintains that others features, including "within-case analysis and replication logic", are unique to the inductive, case-oriented process. Overall, the process by Eisenhardt (1989) is described is highly iterative and tightly linked to the data. This research approach is especially appropriate in new topic areas. The resultant theory, according to Eisenhardt (1989), is often "novel, testable, and empirically valid". Finally, frame-breaking insights, the tests of good theory (e.g., parsimony, logical coherence), and convincing grounding in the evidence are the key criteria for evaluating this type of research. (Eisenhardt 1989)

We consider that Eisenhardt's (1989) eight steps ("getting started, selecting cases, crafting instruments and protocols, entering the field, analyzing data, shaping hypotheses, enfolding literature, and reaching closure"; see Table 2) provide a good guidance for case studies.

Table 2 Process of "building theory from Case Study Research" (Eisenhardt 1989, p. 533)

Step	Activity	Reason
Getting started	Definition of research question Possibly a priori constructs Neither theory nor hypotheses	Focuses efforts Provides better grounding of construct measures Retains theoretical flexibility
Selecting cases	Specified population Theoretical, not random, sampling	Constrains extraneous variation and sharpens external validity Focuses efforts on theoretically useful cases – i.e., those that replicate or extend theory by filling conceptual categories
Crafting instruments and protocols	Multiple data collection methods Qualitative and quantitative data combined Multiple investigators	Strengthens grounding of theory by triangulation of evidence Synergistic view of evidence Fosters divergent perspectives and strengthens grounding
Entering the field	Overlap data collection and analysis, including field notes Flexible and opportunistic data collection methods	Speeds analyses and reveals helpful adjustments to data collection Allows investigators to take advantage of emergent themes and unique case features
Analyzing data	Within-case analysis Cross-case pattern search using divergent techniques	Gains familiarity with data and preliminary theory generation Forces investigators to look beyond initial impressions and see evidence thru multiple lenses
Shaping hypotheses	Iterative tabulation of evidence for each construct Replication, not sampling, logic across cases Search evidence for "why" behind relationships	Sharpens construct definition, validity, and measurability Confirms, extends, and sharpens theory Builds internal validity
Enfolding literature	Comparison with conflicting literature Comparison with similar literature	Builds internal validity, raises theoretical level, and sharpens construct definitions Sharpens generalizability, improves construct definition, and raises theoretical level
Reaching closure	Theoretical saturation when possible	Ends process when marginal improvement becomes small

Cecez-Kecmanovic et al., in their analysis of IS history, see that

> Eisenhardt (1989), Yin (1984), and Dubé and Paré (2003) found that rigor in case study research in IS outlets was lacking. Based on the review of case study publications in seven

> IS journals from 1990-1999, they found that a large percentage of published case study articles either ignored or applied the standards only partially. Arguing for the necessity of advancing the rigor of positivist case study methodology Dubé and Paré (2003) proposed additional recommendations for (1) design issues, (2) data collection, and (3) data analysis. (Cecez-Kecmanovic et al. 2020, pp. 250-251)

2.2 Positivist studies

Straub et al. (1994) surveyed how senior researchers, reviewers and editors of four journals (523 IS professionals) evaluated 15 criteria for high-quality research. The authors used factor analysis to find four standards (guidelines and factors): I. Conceptual Significance, II. Practical Significance, III. Conduct of Research, and IV. Presentation of Research. After the 1994 article, we show how Straub and two colleagues (2004) supplemented previous standards with validation guidelines. Recently, Karahanna et al. (2018) updated the guidelines with recommendations for online experiments.

Straub et al. (1994)

The problem of high manuscript rejection rates

Straub, Ang and Evaristo write that:

> reviewers are making fine discriminations that result in the publication of only the best work, they may also discourage and disaffect the scholarly community (Rackoff, 1985). In many situations, the community perceives these rates to be unreasonable, setting unreachable thresholds for the bulk of the profession. ... Novice researchers, unfamiliar with how best to make their case and with how to deal with the substance and mechanics of the journal reviewing process, are particularly vulnerable to this natural and very human reaction. (Straub et al. 1994, p. 21)

Novice researchers become discouraged and disaffected with the review process.

The value of explicit standards

The authors state:

> This paper contends that manuscript quality can be improved by making explicit, to authors and reviewers alike, the standards that are being used when manuscripts are rejected or accepted. The straightforward and simple argument is that scientific journals should adopt a total quality management perspective and that this is their proper role. (Straub et al. 1994, p. 22)

Straub et al. continue:

> Does IS have a set of mutually agreed-upon, unambiguous objectives and professional standards for acceptable, high quality manuscripts? A careful look at the top journals and their practices suggests that we do not. Nowhere, perhaps, is this lack of common standards more evident than in the evaluation forms that the reviewers are required to send in with each manuscript reviewed, as shown in Table 1 [Table 3]. A glance at these criteria,

which presumably should be used in evaluating manuscripts, shows how widely they vary from journal to journal. (Straub et al. 1994, p. 22)

Table 3 Evaluation standards for the top IS journals (Straub et al. 1994, p. 22)

MISQ/DATA BASE	ISR	CACM	Management Science
Relevance Objectives Readability Organization Literature review Methodology Quality of evidence Contribution Potential contribution	Significance of contribution Technical adequacy Appropriateness to journal Clarity of presentation & significance	Technical content Originality Style and organization Overall quality	Importance of research Impact on discipline Impact on practice Presentation

(MISQ = *MIS Quarterly*, ISR = *Information Systems Research*, CACM = *Communications of the ACM, Management Science*)

Niedermann (2020) argues, these are not standards, but categories of evaluation. None of them say "how much relevance" differentiates those accepted from those not accepted.

Literature review

Straub et al. write:

> Although the underlying dimensions for high quality IS research have not been enunciated for the IS scientific community, there have been numerous studies of publication standards in sociology, psychology, organization behavior, and the physical sciences, as shown in Table 2 [Table 4]. (Straub et al. 1994, p. 22)

Table 4 Criteria for high-quality research (Straub et al. 1994, p. 23)

Criteria	Chase (1970)	Wolff (1970)	Price (1985)	Daft (1985)	Mitchell (1985)
1. Statistical /mathematical analysis	x	x			x
2. Theory	x	x	x	x	
3. Coverage of significant literature	x	x	x		
4. Professional style & tone		x		x	x
5. Logical rigor	x		x	x	x
6. Contribution to knowledge	x	x	x		x
7. Contribution to practice	x	x	x		
8. Presentation level		x			
9. Research design		x		x	x
10. Adherence to scientific ethics	x				
11. Manuscript length		x			
12. Reputation		x			
13. Replicability of research	x	x			
14. Suggestions for future research		x	x		
15. Topic selection	x	x		x	x

The authors chose criteria for acceptance of scientific articles from the following sources (editors): Chase (1970), Wolff (1970), Price (1985), Daft (1985) and Mitchell (1985). Straub et al. conclude:

> Results showed consistent agreement on the relative importance of manuscript criteria. Editors rated contribution to knowledge as the most important criterion, followed closely by sound research design and objectivity in reporting results. Findings indicated that an author's reputation and institutional affiliation were least important in manuscript assessment. (Straub et al. 1994, p. 23)

Research questions for the present study

Straub et al. state:

> Taken together, these studies demonstrate that scientific disciplines do emphasize different criteria in judging research. But because no prior study has assessed these standards for IS, criteria for IS research are unknown at this time. It can be argued, of course, that high quality research should meet most of the 15 criteria listed in Table 2. But the counter argument is that the IS community, like other scientific communities, will inevitably value some criteria more than others and, therefore, stress a subset of these criteria as most critical for new ideas to gain acceptance. Then too, while many of these criteria have been emphasized in doctoral programs and research methodology treatises, greater stress can and should be placed on disseminating these critical success factors (CSFs) to the entire IS scientific community so that we can reach a higher level of agreement. This self-reflective and introspective understanding of CSF criteria might lead to greater convergence on standards for papers submitted to IS journals. (Straub et al. 1994, pp. 23-24)

The authors explain that:

> Prior studies on publication standards in fields such as psychology, sociology, and the physical sciences do not differentiate criteria according to type of research methodology. However, we believe methodology clearly dictates the relative importance of some criteria over others. ... To differentiate criteria according to type of research, the first research question (RQ1) addresses possible variation in the order of importance of criteria across IS methodologies. The first research question, therefore, focuses on how IS researchers rank individual criteria within each methodology. (Straub et al. 1994, p. 24)

Straub et al. view the following:

> In terms of the review process, therefore, we can expect a higher quality of submissions and a higher rate of acceptances if these standards are articulated, generally subscribed to, and reflected in higher quality manuscripts. The second research question (RQ2) addresses whether it is possible to derive a parsimonious set of meaningful standards for IS research. (Straub et al. 1994, p. 24)

Methodology

The authors argue that:

> To answer the research questions, it was determined that a survey of the perceptions of published IS authors and editors would be the most appropriate methodological choice. Accordingly, a questionnaire dealing with criteria for evaluating the quality of IS journal articles was developed. Fifteen criteria, shown in Table 4 [2], were consolidated from studies conducted in other disciplines. (Straub et al. 1994, p. 25)

Straub et al. describe that:

> To obtain a representative sample of the IS scientific community, names and affiliations of authors and editorial board members were drawn from complete volumes of the CACM, Management Science, MISQ, and Information & Management for the period from 1985 to 1989. The final sample included 523 IS professionals. (Straub et al. 1994, p. 25)

The authors state that six methodologies were chosen: 1) case studies, 2) field experiments, 3) field studies, 4) laboratory experiments, 5) conceptual studies and 6) reviews or tutorials. Methodologies 2), 3) and 4) were later called quantitative, and methodologies 1), 5) and 6) qualitative. First, we understand that Straub et al. (1994) covered the whole IS research continuum. Second, Straub et al. (1994) also covered case studies for which Benbasat et al. (1987) had provided guidelines.

Straub et al. state that:

> Respondents were asked to select two research methodologies they felt most comfortable reviewing. For each methodology, respondents rated 15 criteria on a 9-point scale ranging from "not important" to "critically important. " A sample copy of a survey sent to one of the participants appears in Appendix A. To control for order effects, criteria were uniquely ordered for each questionnaire (Muller, et al., 1982; Perrault, 1975-76). Each respondent, therefore, received a unique ordering of the questions, generated randomly by a computer program. (Straub et al. 1994, p. 25)

Results

The authors state that of 523 questionnaires sent out. Of these (27,5 %) 144 were returned. Most of the respondents were from North America. In tests no non-response bias was found. Straub et al. conclude that:

> To address the first research question, rank-ordered mean ranks of criterion ratings for all six methodologies appear in Appendix B. As shown in Appendix B, criteria vary in importance across methodologies. One criterion in particular surfaced as crucial. As might be expected, contribution to knowledge was ranked first in three of six methodologies. Emphasis on this criterion concurs with the results of Wolff (1970) in psychology and Mitchell, et al., (1985) in organizational behavior. (Straub et al. 1994, p. 26)

The authors also see which criteria belonged to high- and low-ranked sets. The ranking also suggested that theory was viewed as a key criterion across all types of research.

The authors wanted:

> To determine if there was a more parsimonious set of standards that could be used to characterize IS research, a principal components factor analysis was run on 281 evaluations (7 data points were missing). Using orthogonal rotation, the rotated factor structure with the highest explained variance (90%) is shown in Appendix C. (Straub et al. 1994, p. 27)

They found the factors in the following order: 1) Conduct of Research (replication, statistical/mathematical analysis, research design and scientific ethics), 2) Presentation (professional style, presentation style, length, logical rigor), 3) Conceptual Significance (coverage of significant literature, theory, suggest future research, contribution knowledge) and 4) Practical Significance (contribution to practice, topic). (Straub et al. 1994)

Discussion

Straub et al. summarize that:

> Overall, our study showed that criteria varied in relative importance for judging IS journal submissions. Nevertheless, a few criteria were consistently more important than other criteria. Contribution to knowledge, coverage of significant literature, logical rigor and use of theory were rated as important criteria regardless of methodology. Contribution to knowledge, in particular, was deemed essential under all circumstances. This result confirms the conclusion of Daft, et al ., (1987) that the ability to add to our knowledge about a topic is the single most important factor in differentiating significant from not-so-significant research. The best research will be based on a thorough and demonstrated knowledge of the literature that rests on theoretical foundations and carries the weight of its argument by showing how this research extends core knowledge in the field. (Straub et al. 1994, p. 27)

The authors also state:

> If the results of the rankings by method are examined from the point of view of qualitative versus quantitative research (Straub, 1989 ; Kaplan and Duchon, 1988), highly interesting patterns emerge. From this perspective, case studies, which rely on relatively little statistical analysis, fall into a category with conceptual studies and reviews/tutorials as qualitative research, whereas field studies, field experiments, and laboratory experiments, which place more reliance on statistical analysis, are remarkably similar in patterns of criteria importance and may be thought of as quantitative research. (Straub et al. 1994, pp. 27-28)

Suggested Normative Standards for Journal Evaluation Form (and items in factors in brackects, cf. Table 4)

I. Conceptual Significance (Replication, Statistical/mathematical analysis, Research design, Scientific ethics)
II. Practical Significance (Contribution to practice, Topic)
III. Conduct of Research (Coverage of significant literature, Theory, Suggest future research, Contribution to knowledge)
IV. Presentation of Research (Professional style, Presentation level, Length, Logical rigor)
(Straub et al. 1994, Appendix D, p. 34)

Review of Straub et al. (1994)

It is important that Chua (1986) evaluated this domain as mainstream (first), and the perceived standards as second. In factor analysis, a certain factor can be considered a (formative) construct. A researcher normally gives a name to a particular factor or construct. Thus, we are unsure whether the reader will understand this name in the same way as the researcher. Therefore, we agree with the authors and recommend that

> Contribution to knowledge, coverage of significant literature, logical rigor and use of theory (Straub et al. 1994)

could be kept as guidelines instead of as standards above.

Although we otherwise appreciate this article, we have some comments about the content:

1. Straub et al. (1994) used standards from sociology, psychology, organization behavior and physical sciences (Table 2) as the basis for the evaluation of standards for IS.
   a) Although senior researchers, reviewers and editors were respondents in this study, they could not suggest a new criterion. They had to use previously defined ones (cf. open vs. closed questions on the questionnaire).
   b) We are not sure whether the sample was representative.
2. The authors used a 9-point scale ranging from "not important" to "critically important". Variables based on this kind of scale are ordinal, not interval. Instead, Straub et al. (1994) used correlation coefficients and factor analysis. Such calculations are not allowed.
3. The low response rate in Straub et al.'s (1994) study was 27,5 %. Although no t-tests were statistically significant at the 0.5 level, we cannot trust it, because it is possible to compute a t-test that is based on variables with an interval scale. In this study, the variables had an ordinal scale only.
4. All the journals were from the United States.
5. The authors presented standards in the following order: I. Conceptual Significance, II. Practical Significance, III. Conduct of Research and IV. Presentation of Research. After factor analysis the order based on the highest variance explained was: 1) Conduct of Research, 2) Presentation, 3) Conceptual Significance, and 4) Practical Significance. Why did the two orders differ?
6. After factor analysis, (factor 2) Guideline 2 "Presentation" consists of variables: professional style, presentation style, length and logical rigor. The three first variables clearly belong to presentation, but the last one, logical rigor, could also be included in factor 4, Practical Significance, as its eigenvalue then is higher than in factor 2. "Logical rigor" concerns all the other guidelines (Conduct of Research, Conceptual Significance and Practical Significance), too.
   A researcher names factors. But does a reader, a reviewer and an editor understand a name of a certain factor in the same way as a researcher?

Straub et al. (2004)

Straub, Boudreau and Gefen suggest

> heuristics for reinvigorating the quest for validation in IS research via content /construct validity, reliability, manipulation validity, and statistical conclusion validity. New guidelines for validation and new research directions are offered. (Straub et al. 2004, p. 380)

(Notice, Straub (2004) has two different colleagues than for the 1994 work.)
Straub et al. state:

> Two broadly stated guidelines emerge from the present study: research validities and innovation in instrumentation. Table 7 [Table 5] lists the research validities and indicates the recommendation for them. (Straub et al. 2004, p. 412)

Their guidelines supplemented Straub et al.'s (1994) standards.

Table 5 Guidelines for research validities (Straub et al. 2004, p. 412)

Validity	**Recommendation**
Content validity	Highly recommended
Construct validity	Mandatory
Predictive validity	Optional
Reliability (internal consistency)	Mandatory (where appropriate)
Reliability (split halves)	Optional in mature research streams
Reliability (alternative forms)	Optional in mature research streams
Inter-rater reliability	Mandatory (where appropriate)
Unidimensional Reliability	Optional
Manipulation validity for experiments	Mandatory (where appropriate)
Nomological validity	Highly recommended
Common methods bias	Highly recommended
Statistical conclusion validity	Mandatory
Instrumentation	**Recommendation**
Use of previously validated instruments	Highly recommended
Creation of newly validated instruments	Highly recommended

Karahanna et al. (2018)

Karahanna, Benbasat, Bapna and Rai (2018) state:

> The purpose of this editorial is to highlight the reasons that have propelled new types of experiments, categorize these along a set of dimensions, discuss their strengths and weaknesses, and highlight some new issues that emerge with these new opportunities for research. Our objective is not to be exhaustive in terms of the various types of experiments but to highlight opportunities and challenges that emerge for online variants that are more prominently seen in IS research. We, therefore, constrain our focus to lab, field, and natural experiments and their online variants. (Karahanna et al. 2018, p. iii)

The authors guide us by saying:

> However, as we alluded to, the move to online experiments may lead to different strengths and tradeoffs for the different types of experiments. Further, new threats to validity may arise that need to be mitigated. Below we discuss these issues for different types of experiments (see Table 1 [Table 6]). (Karahanna et al. 2018, p. iv)

Table 6 Issues and best practices for online experiments (Karahanna et al. 2018)

	Strengths and Limitations of Traditional Versions	**Advantages of Online Variants**	**Issues and Best Practice for Online Variants**
Lab Experiments	• High internal validity (control) • Low realism • Low generalizability • Ease of replicability	• Ability to recruit a broader range of subjects increases external validity • Ability to accommodate large numbers of subjects who can participate in an online lab experiment simultaneously removes time and space constraints and increases efficiency of conducting the studies • Ability to leverage participants' own settings for lab-in-the field experiments to increase realism	• Loss of control over subjects and environment can threaten internal validity. • Loss of ability to collect verbal protocols, but can leverage online observational trace data to rule out alternative causal mechanisms. • Use diversity in subject pool to detect heterogeneous treatment effects. • Use participants' settings in lab-in-field experiments to evaluate how differences in field settings influence treatment effects.
Randomized Field Experiments		• Availability of large samples can enable identification of heterogeneous treatment effects • Ability to leveraging trace data that captures users' online behaviors can help identify underlying causal mechanisms that are based on behaviors	• Ensure that treatment and control groups are equivalent by collecting pretreatment data for treatment and control groups (A/A testing). • Potential selection bias in cases where subjects randomly assigned to a treatment can opt out of the treatment, which can threaten causal inference on downstream variables (other than the immediate outcome), needs to be statistically addressed. • Combine machine learning with causal inference methods to adjust for differences between treated and control groups in high-dimensional settings and detect and estimate heterogeneous treatment effects. • Underlying causal mechanisms involving perceptions or beliefs may be difficult to tap into; computational approaches applied to trace data

			can be used to estimate perceptions and beliefs in some cases. Supplemental lab experiments can also be used to tap into these. • Obtaining informed consent can be challenging; even when this is the case, researchers should assess risks and benefits and debrief participants after the study.
Natural Experiments	• Causal inference can be tenuous • High realism • Generalizability depends on how representative the field setting is	• Persistent online trace data enable researchers to leverage, *a posteriori*, changes in policies or design for causal inference	• Lack of randomization creates challenges in making causal inferences. • Collection of pre-treatment data is critical to making causal inference. • Matching with subjects that did not receive the treatment can be used to estimate the treatment effect; providing evidence of the quality of such matching is a key consideration.

Unless otherwise stated, online variants share the same advantages and limitations as their traditional counterparts. (Karahanna et al. 2018, p. v)

In addition to lab experiments, randomized field experiments and natural experiments, all online, this editorial contains three objectives: causal inference, realism and generalizability that are efficiently used to evaluate lab, field and natural experiments online.

2.3 Interpretive in-depth case study and interpretive field study

Klein and Myers (1999) discuss "conducting and evaluating of interpretive research" in information systems. The authors present seven guidelines for interpretive field studies:

1. The Fundamental Principle of the Hermeneutic Circle,
2. The Principle of Contextualization,
3. The Principle of Interaction between the Researchers and the Subjects,
4. The Principle of Abstraction and Generalization,
5. The Principle of Dialogical Reasoning,
6. The Principle of Multiple Interpretations, and
7. The Principle of Suspicion.

We focus mainly on this article and supplement it with Boland et al. (2010). We exclude Sarker et al. (2013), because they consider qualitative studies in general, and they mix positivist and interpretive studies.

Klein and Myers (1999)

Introduction

Klein and Myers inform:

> In recent years, interpretive research has emerged as an important strand in information systems research (Walsham 1995b). Interpretive research can help IS researchers to understand human thought and action in social and organizational contexts; it has the potential to produce deep insights into information systems phenomena including the management of information systems and information systems development. As the interest in interpretive research has increased, however, researchers, reviewers, and editors have raised questions about how interpretive field research should be conducted and how its quality can be assessed. (Klein and Myers 1999, p. 67)

The authors state:

> This paper can be seen as a response to the call 'to discuss explicitly the criteria for judging qualitative, case and interpretive research in information systems' (Lee et al. 1995, p. 367). Therefore, just as principles and guidelines for case studies were provided by analyzing them from the philosophical perspective of positivism (Lee 1989), this paper will do the same for interpretive field research, but from the philosophical perspective of hermeneutics. (Klein and Myers 1999, p. 68)

Klein and Myers give two reasons for their paper:

> Our claim is simply that we believe our proposed principles are consistent with a considerable part of the philosophical base of literature on interpretivism and hence an improvement over the status quo. ... another important purpose in publishing these principles along with their philosophical rationale is to further debate on the important subject of grounding interpretive research methodology. (Klein and Myers 1999, p. 68)

The authors help readers to understand the interpretive research by explaining its nature and differentiating it from two other approaches. They use Chua's (1986) three epistemologies (positivist, interpretive and critical) and describe them:

> Generally speaking, IS research can be classified as positivist if there is evidence of formal propositions, quantifiable measures of variables, hypothesis testing, and the drawing of inferences about a phenomenon from a representative sample to a stated population (Orlikowski and Baroudi 1991). (Klein and Myers 1999, p. 69)

> IS research can be classified as critical if the main task is seen as being one of social critique, where by the restrictive and alienating conditions of the status quo are brought to light. Critical research seeks to be emancipatory in that it aims to help eliminate the causes of unwarranted alienation and domination and thereby enhance the opportunities for realizing human potential (Alvesson and Wilmott 1992b; Hirschheim and Klein 1994). To make this possible, critical theorists assume that people can consciously act to change their social and economic conditions. They do, however, recognize that human ability to improve their conditions is constrained by various forms of social, cultural, and political domination as well as natural laws and resource limitations. (Klein and Myers 1999, p. 69)

> IS research can be classified as interpretive if it is assumed that our knowledge of reality is gained only through social constructions such a language, consciousness, shared meanings, documents, tools, and other artifacts. Interpretive research does not predefine dependent and independent variables, but focuses on the complexity of human sense making as the situation emerges (Kaplan and Maxwell 1994); it attempts to understand phenomena through the meanings that people assign to them (Boland 1985, 1991; Deetz 1996; Orlikowski and Baroudi 1991). Interpretive methods of research in IS are "aimed at producing an understanding of the context of the information system, and the process whereby the information system influences and is influenced by the context" (Walsham1993, pp. 4-5). (Klein and Myers 1999, p. 69)

Klein and Myers state:

> Keeping the above definition of interpretive research in mind, the scope of this paper is limited to addressing the quality standards of only one type of interpretive research, namely, the interpretive field study. Field studies include in depth case studies (Walsham 1993) and ethnographies (Suchman 1987; Wynn 1979, 1991; Zuboff 1988). (Klein and Myers 1999, p. 69)

The authors explain their view in more detail:

> The approach used in this paper was to analyze the literature on the philosophy of interpretivism for insights that could ground a methodology for the conduct and evaluation of interpretive field studies. We have summarized the key results of our analysis of this philosophical base in seven principles, which are discussed in the next section. We decided to concentrate on the hermeneutic philosophers, especially Gadamer and Ricoeur, for a few reasons. First, the complete literature of interpretive philosophy comprises so many varied philosophical positions that it is unlikely to yield one consistent set of principles for doing interpretive research. What has been called the interpretive paradigm (Burrell and Morgan 1979) is in fact a family paradigms too large and diverse to tackle for this project. However, since hermeneutics is a major branch of interpretive philosophy with Gadamer and Ricoeur arguably being its most well known exponents, it made sense to focus primarily on them -- as well as pay attention to phenomenology as suggested by Boland (1985). Second, hermeneutics has a relatively settled philosophical base and therefore lends itself to being used as a 'bridgehead' for making a contribution to interpretive research methodology. Third, both authors are well versed in interpretive philosophy and hermeneutics in particular. (Klein and Myers 1999, p. 70)

Niederman (2020) states:

> Hermenuetics is largely the study of texts and comes largely from trying to interpret the ”real” meaning of the Bible given its many versions and translations. Using hermeneutics in IS tends to emphasize the nature of IS being in statements about it.

A Set of Principles for Interpretive Field Research

Klein and Myers propose that

> a set of principles for the evaluation of interpretive field research in information systems. There are two sources for these principles: the practice of anthropological research and our understanding of the underlying philosophy of phenomenology and hermeneutics. (Klein and Myers 1999, p. 70)

The authors state that

> Table 1 [Table 7] summarizes the seven principles that we have identified together with illustrative examples from the IS research literature. These seven principles are discussed

in more detail below. We begin with the assumption that the principles for the evaluation of interpretive research are not independent of the guidelines for its conduct. Therefore, our approach is to derive a set of principles for the conduct and reporting of interpretive research and then illustrate that the same principles can also be used for post hoc evaluation. (Klein and Myers 1999, p. 71)

Table 7 Summary of principles for interpretive field research (Klein and Myers 1999, p. 72)

1. The Fundamental Principle of the Hermeneutic Circle This principle suggests that all human understanding is achieved by iterating between considering the interdependent meaning of parts and the whole that they form. This principle of human understanding is fundamental to all the other principles.
2. The Principle of Contextualization Requires critical reflection of the social and historical background of the research setting, so that the intended audience can see how the current situation under investigation emerged.
3. The Principle of Interaction between the Researchers and the Subjects Requires critical reflection on how the research materials (or "data") were socially constructed through the interaction between the researchers and participants.
4. The Principle of Abstraction and Generalization Requires relating the ideographic details revealed by the data interpretation through the application of principles one and two to theoretical, general concepts that describe the nature of human understanding and social action.
5. The Principle of Dialogical Reasoning Requires sensitivity to possible contradictions between the theoretical preconceptions guiding the research design and actual findings ("the story which the data tell") with subsequent cycles of revision.
6. The Principle of Multiple Interpretations Requires sensitivity to possible differences in interpretations among the participants as are typically expressed in multiple narratives or stories of the same sequence of events under study. Similar to multiple witness accounts even if all tell it as they saw it.
7. The Principle of Suspicion Requires sensitivity to possible "biases" and systematic "distortions" in the narratives collected from the participants.

The Fundamental Principle of the Hermeneutic Circle

Klein and Myers state:

> This principle is foundational to all interpretive work of a hermeneutic nature and is in effect a meta-principle upon which the following six principles expand. The idea of the hermeneutic circle suggests that we come to understand a complex whole from preconceptions about the meanings of its parts and their interrelationships. The authors cite 'Thus the movement of understanding is constantly from the whole to the part and back to the whole' (Gadamer 1976b, p. 117). (Klein and Myers 1999, p. 71)

Also Boland et al. (2010) explain the hermeneutic circle.

The Principle of Contextualization

The authors describe:

> The principle of contextualization is based on Gadamer's insight that there is an inevitable difference in understanding between the interpreter and the author of a text that is created by the historical distance between them. Various contexts can be explored (e.g., those associated with the informants or the researchers), the choice largely depending upon the audience and the story the author wants to tell. For some research purposes it may be fruitful to extend Gadamer's viewpoint with a clarification of the power bases which over time have privileged certain beliefs as legitimate truths. (Klein and Myers 1999, p. 73)

Klein and Myers present:

> The contextualization principle requires that the subject matter be set in its social and historical context so that the intended audience can see how the current situation under investigation emerged. ... As a consequence, interpretive research seeks to understand a moving target. In so far as each instance is treated as a unique historical occurrence, interpretive research is idiographic. (Klein and Myers 1999, p. 73)

The Principle of Interaction Between the Researcher(s) and the Subjects

The authors write:

> Whereas the principle of contextualization places the object of study in context, this principle requires the researcher to place himself or herself and the subjects into a historical perspective. In social research, the "data" are not just sitting there waiting to be gathered, like rocks on the seashore. Rather, interpretivism suggests that the facts are produced as part and parcel of the social interaction of the researchers with the participants. (Klein and Myers 1999, p. 74)

Klein and Myers see that:

> interpretive researchers must recognize that the participants, just as much as the researcher, can be seen as interpreters and analysts. Participants are interpreters as they alter their horizons by the appropriation of concepts used by IS researchers, consultants, vendors, and other parties interacting with them, and they are analysts in so far as their actions are altered by their changed horizons. (Klein and Myers 1999, p. 74)

The Principle of Abstraction and Generalization

(The authors write about this principle in different ways than previously. We pick up some important text phrases in the middle of this principle in the article.) Klein and Myers see that:

> it is important that theoretical abstractions and generalizations should be carefully related to the field study details as they were experienced and/or collected by the researcher. This is so readers can follow how the researcher arrived at his or her theoretical insights. (Klein and Myers 1999, p. 75)

The authors clarify their view on abstraction and theory as follows:

> The principle of abstraction with its philosophical backing in the works of Heidegger and Husserl supports Walsham's argument that the validity of the inferences drawn from one or more cases does not depend on the representativeness of cases in a statistical sense,

'but on the plausibility and cogency of the logical reasoning used in describing the results from the cases, and in drawing conclusions from them' (Walsham 1993, p. 15; see also Lee 1989). Walsham argues that there are four types of generalizations from interpretive case studies: the development of concepts, the generation of theory, the drawing of specific implications, and the contribution of rich insight (Walsham1995a). The key point here is that theory plays a crucial role in interpretive research, and clearly distinguishes it from just anecdotes. The authors use 'theory' as 'sensitizing device'. (Klein and Myers 1999, p. 75)

The Principle of Dialogical Reasoning

Klein and Myers describe:

> This principle requires the researcher to confront his or her preconceptions (Prejudices) that guided the original research design (i.e., the original lenses) with the data that emerge through the research process. The most fundamental point is that the researcher should make the historical intellectual basis of the research (i.e., its fundamental philosophical assumptions) as transparent as possible to the reader and himself or herself. (Klein and Myers 1999, p. 76)

The authors emphasize the role of hermeneutics in principles as it:

> recognizes that prejudice is the necessary starting point of our understanding. The critical task of hermeneutics then becomes one of distinguishing between 'true prejudices, by which we understand, from the false ones by which we misunderstand' (Gadamer 1976b, p. 124). (Klein and Myers 1999, p. 76)

The Principle of Multiple Interpretations

Klein and Myers describe this principle as follows:

> Whereas it is possible to apply the previous principles to texts from only one source, this would ignore that human actions are conditioned by a social context involving multiple agents. The principle of multiple interpretations requires the researcher to examine the influences that the social context has upon the actions under study by seeking out and documenting multiple viewpoints along with the reasons for them. The analysis of reasons may include seeking to understand conflicts related to power, economics, or values. Moreover the researcher should confront the contradictions potentially inherent in the multiple viewpoints with each other, and revise his or her understanding accordingly. This follows from Ricoeur's (1974) work, The Conflict of Interpretations. These revisions are similar to the application of the hermeneutic rule referred to in the principle of dialogical reasoning, except that it is not a confrontation of the researcher's preconceptions and the data, but a confrontation of conflicting interpretations of the participants in the field. In either case, revisions of the researcher's preconceptions may be the outcome. (Klein and Myers 1999, p. 77)

The Principle of Suspicion

The authors repeat that:

> Even though the above principles already encourage various forms of critical thinking, on the whole they are more concerned with the interpretation of meanings than with the discovery of 'false preconceptions'. We therefore adapt the principle of suspicion from Ricoeur (1976). what he describes as a 'hermeneutics of suspicion', Ricoeur argues that it is possible in certain circumstances to see consciousness as 'false' consciousness (Ricoeur 1976, pp. 194-203). (Klein and Myers 1999, p. 77)

Klein and Myers cite Deetz regarding concretization:

> Either explicit or implicit in critical work is a goal to demonstrate and critique forms of domination, asymmetry, and distorted communication through showing how social constructions of reality can favor certain interests and alternative constructions can be obscured and misrecognized (Deetz 1996, p. 202). (Klein and Myers 1999, p. 77-78)

The authors then show the interdependence of the seven principles. They also state that any principle is not necessary, but as many principles as possible may give a many-sided picture.

Three Examples of Interpretive Field Research in Information Systems

Klein and Myers discuss three studies (Orlikowski 1991, Walsham and Waema 1994, Myers 1994). They use the structure of principles as previously.

Discussion and Conclusions

The authors write:

> Interpretive research has emerged as a valid and important approach to information systems research. ... We do believe, however, that explicit articulation of the principles is a contribution to improving interpretive field research methodology in information systems in the following ways. First, we have managed to crystallize a diffuse literature into a manageable principles for those who accept philosophical hermeneutics as a foundation for interpretive research. ... Second, researchers can now defend their work by appealing to principles that are firmly grounded in at least one major direction of interpretive philosophy. ... Third, the introduction of a set of principles encourages researchers to consider each one of the principles systematically and ensures that none has left out arbitrarily. (Klein and Myers 1999, p. 87)

Sarker et al. (2013)

The authors consider qualitative studies in general. They based their analysis of qualitative research in IS as represented in publications between 2001 and 2012 in four of the leading IS journals. They analyze positivist and interpretative case studies together. However, we have Benbasat et al. (1987) and Straub et al. (1994) for positivist case studies, and Klein and Myers (1999) for interpretive case studies. Sarker et al. (2013) did not differentiate those two case study categories, thus, we cannot use their good article.

Review of Klein and Myers (1999)

Klein and Myers based their seven principles on Gadamer's and Ricour's philosophical works. Although the seven principles are slightly interdependent, they cover a wide domain of interpretivism. Almost all are clearly presented and well supported. Chen and Hirschheim (2004) examined 1893 articles published in eight major IS publication outlets between 1991 and 2001. Their findings suggested that the long-term endeavors of interpretivist researchers might need to continue because the paradigmatic progress appears inconsequential. Chen and Hirschheim (2004) further suggested that "positivist research still dominates 81 % of published empirical research". They also found that interpretive studies accounts for less than 20 % (Chen & Hirschheim 2004). Recently, Cecez-Kecmanovic et al. evaluated that

> Klein and Myers's (1999) principles made an important and lasting contribution to understanding, conducting, and evaluating interpretive field study research in IS. (Cecez-Kecmanovic et al. 2020, p. 250)

Although we much appreciate this article, we have some comments:

1. The fourth principle is written slightly differently from the others, and it unsettles the reader.
2. Klein and Myers state that action research can be positivist (Clark 1972), interpretive (Elden and Chisholm 1993) or critical (Carr and Kemmis 1986) similar to case study (cf. Chua 1986). Action research (AR) is similar to design science (DS) research (Hevner et al. 2004, Järvinen 2007a), not to case study. AR and DS differ from other methdologies because of their emphasis of utility.
3. Klein and Myers appreciate:

> One of the key contributions of the research methods stream in IS research has been the formulation of a set of methodological principles for case studies that were consistent with the conventions of positivism (Benbasat et al. 1987; Lee 1989; Yin 1994). As a result, case study research is now accepted as a valid research strategy within the IS research community. The principles proposed in this stream of work have become the de facto standard against which most case study research in IS is evaluated. (Klein and Myers 1999, p. 68)

Unfortunately, Benbasat et al. (1987) do not include written principles although Klein and Myers thus assert, for they refer to the abstract by Benbasat et al. (1987) not to the whole article. Cecez-Kecmanovic et al. (2020, p. 250) also made the same mistake.

4. We propose a new principle: 8. The Principle of Communication. It is hoped that a communication between a researcher and a practitioner should be successful. Barley (1996) studied with his co-workers technicians a long time. The objects / technicians said after one year's study that the researchers' description concerning technician's work is correct, maybe more exactly decsribed than they themselves could do. Another article states that it is based a four-year longitudinal case study of a French multinational corporation (MNC) ... in its Chinese subsidiaries. "The main source of data is 57 open-ended and semi-structured interviews. Interviews were conducted face to face and in English (the second language of most of the participants)." (Malaurent and Karanasios 2020, p. 647) We are afraid that the French interviewer did not have the Chinese worldview in interviewing.

2.4 Design science

Hevner, March, Park and Ram (2004) developed a framework for IS research. It has had a tremendous effect on IS studies. This article was the fourth most-

highly cited article ever published in *MISQ* (Goes 2014), and is a "must read" article. Instead, we present these two articles chronologically. March and Smith (1995) introduced design research to information systems. They prepared a framework and four classes of research outputs that were later utilized in Hevner et al. (2004). According to Goes (2014) this article (March and Smith 1995) was based on discussions in the Workshop of Information Technology and Systems (WITS) established as a pre-ICIS workshop since 1990.

March and Smith (1995)

(March states that this paper is an extension of ideas originally presented at 1992 in their WITS seminar.)

1. Introduction

At the beginning March and Smith define:

> Information technology is technology used to acquire and process information in support of human purposes. (March and Smith 1995, p. 252)

They highlight the purpose of their article (p. 252):

> IT has attracted scientific attention, in part because of its potential for dramatically impacting organizational effectiveness, both positively and negatively. Scientists have also been drawn by the pervasiveness of IT phenomena in our information-based society. Scientific interest in IT reflects assumptions that these phenomena can be explained by scientific theories and that scientific research can improve IT practice. Note, however, that there are two kinds of scientific interest in IT, descriptive and prescriptive. Descriptive research aims at understanding the nature of IT. It is knowledge-producing activity corresponding to natural science. Prescriptive research aims at improving IT performance. It is a knowledge-using activity corresponding to design science. (March and Smith 1995, p. 252)

The authors emphasize truth and utility in IT research.

2. Theoretical background

March and Smith present many important differentiations for their message. Therefore, we cite much of their text. The authors write:

> IT research studies artificial as opposed to natural phenomena. It deals with human creations such as organizations and information systems. This has significant implications for IT research which is discussed later. Of immediate interest is that fact that artificial phenomena can be both created and studied, and that scientists can contribute to each of these activities. This underlies the dual nature of IT research. Rather than being in conflict, however, both activities can be encompassed under broad notion of science that includes two distinct species, termed natural and design science. Natural science is concerned with explaining how and why things are. Design science is concerned with 'devising artifacts to attain goals' (Simon 1981, p. 133). (March and Smith 1995, p. 253)

> Natural science is often viewed as consisting of two activities, discovery and justification. Discovery is the process of generating or proposing scientific claims (e.g., theories, laws). Justification includes activities by which such claims are tested for validity. (March and Smith 1995, p. 253)

> Whereas natural science tries to understand reality, design science attempts to create things that serve human purposes. It is technology-oriented. Its products are assessed against criteria of value or utility – does it work? is it improvement? (March and Smith 1995, p. 253)

> Design science products are of four types: constructs, models, methods, and implementations. As in natural science, there is a need for a basic language of concepts (i.e., constructs) with which to characterize phenomena. These can be combined in higher order constructions, often termed models, used to describe tasks, situations, or artifacts. Design scientists also develop methods, ways of performing goal-directed activities. Finally, the foregoing can be instantiated in specific products, physical implementations intended to perform certain tasks. (March and Smith 1995, p. 253)

March and Smith also state:

> Design science consists of two basic activities, build and evaluate. These parallel the discovery-justification pair from natural science. Building is the process of constructing an artifact for a special purpose; evaluation is the process of determining how well an artifact performs.
>
> However, natural science can address both natural and artificial phenomena. … Rather than being driven by research topic, the natural-design science distinction is based on different research objectives. Natural science aims at understanding and explaining phenomena; design sciences aims at developing ways to achieve human goals.
>
> The distinction between basic and applied science is also relevant. … More relevant is the description-prescription distinction frequently employed by decision scientists. Natural science is descriptive and explanatory in intent. Design science offers prescriptions and creates artifacts that embody those prescriptions. (March and Smith 1995, p. 254)

3. A research framework of information technology

The authors present:

> Our proposed framework is driven by the distinction between research output and research activities (Fig. 1) [Figure 1]. (March and Smith 1995, p. 255)

		Research Activities			
		Build	Evaluate	Theorize	Justify
Research Outputs	Constructs				
	Model				
	Method				
	Instantiation				

Figure 1 A research framework (March and Smith 1995, p. 255)

The authors verbally describe their framework:

> The first dimension of the framework is based on design science research outputs or artifacts: constructs, models, methods and instantiations. The second dimension is based broad types of design and natural science research activities: build, evaluate, theorize and justify. (March and Smith 1995, p. 255-256)

Concerning research outputs, March and Smith define the concepts 'construct, model, method and instantiation' and provide some views on their usage:

> Constructs or concepts form the vocabulary or language of a domain. They constitute a conceptualization used to describe problems within a domain and to specify their solutions. They form a specialized language and shared knowledge of a discipline or subdiscipline. A model is a set of propositions or statements expressing relationships among constructs. In design activities, models represent situations as problem and solution statements. A method is a set of steps (an algorithm or guideline) used to perform a task. Methods are based on a set of underlying constructs (language) and a representation (model) of the solution base. … Methods are often used to translate from one model or representation to another in the course of solving a problem. … Further, methods are often used to translate from one model or representation to another in the course of solving a problem. Natural science uses but does not produce methods. Design science creates the methodological tools that natural scientist use. Research methodologies prescribe appropriate ways to gather and analyze evidence to support (or refute) a posited theory. They are human-created artifacts that have value insofar as they address this task. (March and Smith 1995, p. 256-258)

> An instantiation is a realization of an artifact in its environment. IT research instantiates both specific information systems and tools that address various aspect of designing information systems. Instantiations operationalize construct, models and methods. (March and Smith 1995, p. 258)

The authors describe research activities as follows:

> Research activities in design science are twofold: build and evaluate. Build refers to the construction of the artifact, demonstrating that such an artifact can be constructed. Evaluate refers to the development of criteria and the assessment of artifact performance against those criteria. (March and Smith 1995, p. 258)

> Research activities in natural science are parallel: discover and justify. Discover, or more appropriately for IT research, theorize, refers to the constructions of theories that explain how and why something happens. In the case of IT research this is primarily an explanation of how or why an artifact works within its environment. Justify refers to theory proving. It requires of scientific evidence that supports or refutes the theory. (March and Smith 1995, p. 258)

> We build an artifact to perform a specific task. The basic question is, does it work? Building an artifact demonstrates feasibility. These artifacts then become the object of study. We build constructs, models, methods, and instantiations. Each is a technology that, once built, must be evaluated scientifically. (March and Smith 1995, p. 258)

> We evaluate artifacts to determine if we have made any progress. The basic question is, how well does it work? Recall that progress is achieved when a technology is replaced by more effective one. Evaluation requires the development of metrics and the measurement of artifacts according to those metrics. Metrics define what we are trying to accomplish. They are used to assess the performance of an artifact. Lack of metrics and failure to measure artifact performance according to established criteria result in an inability to effectively judge research efforts. (March and Smith 1995, p. 258)

To apply design science in IT research, March and Smith state:

> Research in the build activity should be judged based on value or utility to a community of users. Building the first of virtually any set of constructs, model, method, or instantiation is deemed to be research, provided the artifact has utility for an important task. The research contribution lies in the novelty of the artifact and in the persuasiveness of the claims that it is effective. Actual performance evaluation is not required at this stage. The

> significance of research that builds subsequent constructs, models, methods, and instantiations addressing the same task is judged based on 'significant improvement', e.g., more comprehensive, better performance. (March and Smith 1995, p. 260-261)

> Research in the evaluate activity develops metrics and compares the performance of constructs, models, methods, and instantiations for specific tasks. Metrics define what a research area is trying to accomplish. Since 'the second' or subsequent constructs, models, methods, or instantiations for a given task must provide significant improvements, evaluation is the key activity for assessing such research. (March and Smith 1995, p. 261)

The authors also preliminarily state criteria for evaluating constructs, models, methods and instantiations:

> Evaluation of constructs tends to involve completeness, simplicity, elegance, understandability, and ease of use. … Models are evaluated in terms of their fidelity with real world phenomena, completeness, level of detail, robustness, and internal consistency. … Evaluation of methods considers operationality (the ability to perform the intended task or the ability of humans to effectively use the method if it is algorithmic), efficiency, generality and ease of use. … Evaluation of instantiations considers the efficiency and effectiveness of the artifact and its impacts on the environment and its users. (March and Smith 1995, p. 261) [italics added]

These criteria are frequently used in evaluating research outputs.

4. Discussion and prescriptions for IT research

March and Smith discuss implications for IT research:

> First, there may not, in fact, be an underlying deep structure to support a theory of IT. Our theories of natural phenomena (i.e. people) that are impacted by the technology. Second, our artifacts are perishable, hence our research results are perishable. As needs change, the artifacts produced to meet those needs also change. A theory of how programmers use a now-defunct language, for example, would be of little interest. Third, we are producing IT artifacts at an ever increasing rate, resulting in innumerable phenomena to study. Explicating and evaluating IT artifacts (constructs, models, methods, and instantiations) will facilitate their categorization so that research efforts will not be wasted building and studying artifacts that have already been built and studied 'in kind'. (March and Smith 1995, p. 263)

Review of March and Smith (1995)

We evaluate March and Smith's IT research framework (Figure 1), their research outputs of design science (constructs, models, methods and instantiations) and evaluation criteria of those four research outputs, very positively. We are very happy that the authors differentiated design and other science from each other. Hevner et al. (2004) broadened March and Smith's results.

Although we much appreciate this article, we have some comments.

1. March and Smith differentiate natural and design science. They use the expression "natural science" but information systems science is normally kept as social science. We guess that the authors wanted to show that their constructions also work in natural sciences where almost mathematical relationships occur but people sometimes can behave otherwise than estimated. - Niederman (2020) recommends:

It is better to consider 3 types of science – physical which is the passive discovery of patterns that humans largely affect only incidentally if at all. Behavioral where humans are treated as machines in the search of patterns that occur regardless of individual traits (or as a determistic result of these) For example, usefulness affecting intention to use is a relationship that occurs in spite of any individuality or agency; where it doesn't work that is considered "error". And artifical science because the creator is front and center. Any individuality and biases in terms of design choices, feature preferences, or ways of using are not "error" (though they may differ from the designer to user intention and implementation) but rather they are the central tendency as to why we build and how we use tools/artifacts.

Niederman seems have the similar base as Iivari (2007, p. 41):

The three worlds of Popper (1978) provide a good starting point for such an ontology. World 1 is about material nature, World 2 about consciousness and mental states, and World 3 about products of human social action. World 3 clearly includes human artifacts, and it also covers institutions and theories, where institutions are social constructions that have been objectified (Berger and Luckman 1967).

2. March and Smith included instantiations also in natural science. They even write:

Instantiations provide working artifacts, the study of which can lead to significant advancements in both design and natural science. (March and Smith 1995, p. 258)

According to Iivari (2007), nature belongs to Popper's World 1 and artifacts to World 3. Thus, we recommend using the term instantiation only in design science, not in natural science.

Hevner et al. (2004)

Introduction

Hevner, March, Park and Ram prepared a framework for IS research and they start with the following:

Information systems are implemented within an organization for the purpose of improving the effectiveness and efficiency of that organization. Capabilities of the information system and characteristics of the organization, its work systems, its people, and its development and implementation methodologies together determine the extent to which that purpose is achieved (Silver et al. 1995). (Hevner et al. 2004, p. 76)

The authors argue that

acquiring such knowledge involves two complementary but distinct paradigms, behavioral science and design science (March and Smith 1995). The behavioral-science paradigm has its roots in natural science research methods. It seeks to develop and justify theories (i.e., principles and laws) that explain or predict organizational and human phenomena surrounding the analysis, design, implementation, management, and use of information systems. (Hevner et al. 2004, p. 76)

They outline that

the design-science paradigm has its roots in engineering and the sciences of the artificial. (Simon 1996) It is fundamentally a problem-solving paradigm. It seeks to create innovations that define the ideas, practices, technical capabilities, and products through which

> the analysis, design, implementation, management, and use of information systems can be effectively and efficiently accomplished (Denning 1997; Tsichritzis 1998). Such artifacts are not exempt from natural laws or behavioral theories. To the contrary, their creation relies on existing kernel theories that are applied, tested, modified, and extended through the experience, creativity, intuition, and problem solving capabilities of the researcher (Markus et al. 2002; Walls et al. 1992). (Hevner et al. 2004, p. 76)

The authors state:

> It is an opportunity for IS research to make significant contributions by engaging the complementary research cycle between design-science and behavioral-science to address fundamental problems faced in the productive application of information technology. (Hevner et al. 2004, p. 76-77)

Hevner at al. broadly define artifacts

> as constructs (vocabulary and symbols), models (abstractions and representations), methods (algorithms and practices), and instantiations (implemented and prototype systems). These are concrete prescriptions that enable IT researchers and practitioners to understand and address the problems inherent in developing and successfully implementing information systems within organizations (March and Smith 1995; Nunamaker et al. 1991a). (Hevner et al. 2004, p. 77)

The authors state:

> Design science, as the other side of the IS research cycle, creates and evaluates IT artifacts intended to solve identified organizational problems. Such artifacts are represented in a structured form that may vary from software, formal logic, and rigorous mathematics to informal natural language descriptions. A mathematical basis for design allows many types of quantitative evaluations of an IT artifact, including optimization proofs, analytical simulation, and quantitative comparisons with alternative designs. (Hevner et al. 2004, p. 77)

Hevner et al. present their objectives as follows:

> The primary goal of this paper is to inform the community of IS researchers and practitioners of how to conduct, evaluate, and present design-science research. We do so by describing the boundaries of design science within the IS discipline via a conceptual framework for understanding information systems research and by developing a set of guidelines for conducting and evaluating good design-science research." (Hevner et al. 2004, p. 77)

A Framework for IS Research

Hevner et al. take Venkatraman and Henderson's (1993) model as their starting point. The authors focus on two meanings of the term "design":

> To achieve a true understanding of and appreciation for design science as an IS research paradigm, an important dichotomy must be faced. Design is both a process (set of activities) and a product (artifact) - a verb and a noun (Walls et al. 1992). It describes the world as acted upon (processes) and the world as sensed (artifacts). (Hevner et al. 2004, p. 78)

Van Aken (2004) supports this view. Based on March and Smith, Hevner et al. identify:

> two design processes and four design artifacts produced by design-science research in IS. The two processes are build and evaluate. The artifacts are constructs, models, methods, and instantiations. Purposeful artifacts are built to address heretofore unsolved problems. (Hevner et al. 2004, p. 78)

Hevner et al. state that

> Figure 2 [Figure 2] presents our conceptual framework for understanding, executing, and evaluating IS research combining behavioral-science and design-science paradigms. We use this framework to position and compare these paradigms. (Hevner et al. 2004, p. 79)

They try to explain the main parts (environment, IS research and knowledge base) of Figure 2.

Regarding the environment, they

> define the problem space (Simon 1996) in which reside the phenomena of interest. For IS research, it is composed of people, (business) organizations, and their existing or planned technologies. In it are the goals, tasks, problems, and opportunities that define business needs as they are perceived by people within the organization. Such perceptions are shaped by the roles, capabilities, and characteristics of people within the organization. Business needs are assessed and evaluated within the context of organizational strategies, structure, culture, and existing business processes. They are positioned relative to existing technology infrastructure, applications, communication architectures, and development capabilities. Together these define the business need or "problem" as perceived by the researcher. Framing research activities to address business needs assures research relevance. (Hevner et al. 2004, p. 79)

Regarding IS research, they state

> Given such an articulated business need, IS research is conducted in two complementary phases. Behavioral science addresses research through the development and justification of theories that explain or predict phenomena related to the identified business need. Design science addresses research through the building and evaluation of artifacts designed to meet the identified business need. The goal of behavioral-science research is truth. The goal of design-science research is utility. (Hevner et al. 2004, p. 79)

Regarding the knowledge base, they state

> Knowledge base provides the raw materials from and through which IS research is accomplished. The knowledge base is composed of foundations and methodologies. Prior IS research and results from reference disciplines provide foundational theories, frameworks, instruments, constructs, models, methods, and instantiations used in the develop/build phase of a research study. Methodologies provide guidelines used in justify/evaluate phase. (Hevner et al. 2004, p. 80)

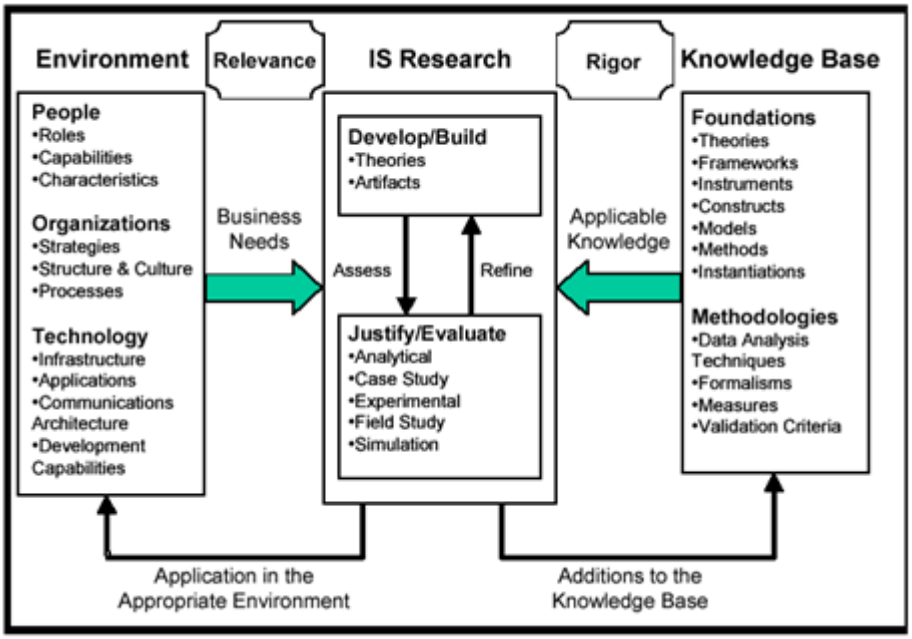

Figure 2 Information systems research framework (Hevner et al. 2004, p. 80)

The authors state the following:

> In design science, computational and mathematical methods are primarily used to evaluate the quality and effectiveness of artifacts; however, empirical techniques may also be employed. (Hevner et al. 2004, p. 80)

> 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. A justified theory that is not useful for the environment contributes as little to the IS literature as an artifact that solves a nonexistent problem. (Hevner et al. 2004, p. 81)

Hevner et al. differentiate routine design or system building from design research as follows:

> The difference is in the nature of the problems and solutions. Routine design is the application of existing knowledge to organizational problems, such as constructing a financial or marketing information system using best practice artifacts (constructs, models, methods, and instantiations) existing in the knowledge base. On the other hand, design-science research addresses important unsolved problems in unique or innovative ways or solved problems in more effective or efficient ways. The key differentiator between routine design and design research is the clear identification of a contribution to the archival knowledge base of foundations and methodologies. (Hevner et al. 2004, p. 81)

Guidelines for Design Science in Information Systems Research

Hevner et al. (2004) help readers follow their ideas by providing seven guidelines for design research:

> The fundamental principle of design-science research from which our seven guidelines are derived is that knowledge and understanding of a design problem and its solution are acquired in the building and application of an artifact. That is, design-science research

> requires the creation of an innovative, purposeful artifact (Guideline 1) for a specified problem domain (Guideline 2). Because the artifact is purposeful, it must yield utility for the specified problem. Hence, thorough evaluation of the artifact is crucial (Guideline 3). Novelty is similarly crucial since the artifact must be innovative, solving a heretofore unsolved problem or solving a known problem in a more effective or efficient manner (Guideline 4). In this way, design-science research is differentiated from the practice of design. The artifact itself must be rigorously defined, formally represented, coherent, and internally consistent (Guideline 5). The process by which it is created, and often the artifact itself, incorporates or enables a search process whereby a problem space is constructed and a mechanism posed or enacted to find an effective solution (Guideline 6). Finally, the results of the design-science research must be communicated effectively (Guideline 7) both to a technical audience (researchers who will extend them and practitioners who will implement them) and to a managerial audience (researchers who will study them in context and practitioners who will decide if they should be implemented within their organizations). (Hevner et al. 2004, p. 82)

The authors' purpose

> for establishing the seven guidelines is to assist researchers, reviewers, editors, and readers to understand the requirements for effective design-science research. Following Klein and Myers (1999), we advise against mandatory or rote use of the guidelines. Researchers, reviewers, and editors must use their creative skills and judgment to determine when, where, and how to apply each of the guidelines in a specific research project. However, we contend that each of these guidelines should be addressed in some manner for design-science research to be complete. How well the research satisfies the intent of each of the guidelines is then a matter for the reviewers, editors, and readers to determine. (Hevner et al. 2004, p. 82)

Table 8 Design-science research guidelines (Hevner et al. 2004, p. 83)

Guideline	**Description**
Guideline 1: Design as an artifact	Design-science research must produce a viable artifact in the form of a construct, a model, a method, or an instantiation.
Guideline 2: Problem relevance	The objective of design-science research is to develop technology-based solutions to important and relevant business problems.
Guideline 3: Design evaluation	The utility, quality, and efficacy of a design artifact must be rigorously demonstrated via well-executed evaluation methods.
Guideline 4: Research contributions	Effective design-science research must provide clear and verifiable contributions in the areas of the design artifact, design foundations, and/or design methodologies.
Guideline 5: Research rigor	Design-science research relies upon the application of rigorous methods in both the construction and evaluation of the design artifact.
Guideline 6: Design as a search process	The search for an effective artifact requires utilizing available means to reach desired ends while satisfying laws in the problem environment.
Guideline 7: Communication of research	Design-science research must be presented effectively both to technology-oriented as well as management-oriented audiences.

Table 8 summarizes the seven guidelines. Each is discussed in detail below in the article, but we bypass all guidelines except Guideline 3. Hevner et al. characterize potential goals as follows:

> The utility, quality and efficacy of a design artifact must be rigorously demonstrated via well-executed evaluation methods. Evaluation is a crucial component of the research process. The business environment establishes the requirements upon which the evaluation of the artifact is based. (Hevner et al. 2004, p. 85)

The authors continue the theme:

> As in the justification of a behavioral science theory, evaluation of a designed IT artifact requires the definition of appropriate metrics and possibly the gathering and analysis of appropriate data. IT artifacts can be evaluated in terms of functionality, accuracy, performance, reliability, usability, fit with the organization, and other relevant quality attributes. (Hevner et al. 2004, p. 85)

Hevner et al. see that:

> Because design is inherently an iterative and incremental activity, the evaluation phase provides essential feedback to the construction phase as to the quality of the design process and the design product under development. A design artifact is complete and effective when it satisfies the requirements and constraints of the problem it was meant to solve. Design-science research efforts may begin with simplified conceptualizations and representations of problems. As available technology or organizational environments change, assumptions made in prior research may become invalid. (Hevner et al. 2004, p. 85)

Sein et al. (2012) later took continuous feedback as a proper part of their action-design-science method.

Hevner et al. (2004) write:

> The evaluation of designed artifacts typically uses methodologies available in the knowledge base. These are summarized in Table 2 [Table 9]. The selection of evaluation methods must be matched appropriately with the designed artifact and the selected evaluation metrics. For example, descriptive methods of evaluation should only be used for especially innovative artifacts for which other forms of evaluation may not be feasible. The goodness and efficacy of an artifact can be rigorously demonstrated via well-selected evaluation methods (Basili 1996; Kleindorfer et al. 1998; Zelkowitz and Wallace 1998). (Hevner et al. 2004, p. 86)

In this context, although the evaluation methods in Table 9 are important, we recommend the Verschuren and Hartog (2005) work, for they see this topic as important and broad. Their view is slightly more versatile and detailed.

Table 9 Design evaluation methods (Hevner et al. 2004, p. 86)

1. Observational	Case study: Study artifact in depth in business environment Field study: Monitor use of artifact in multiple projects
2. Analytical	Static analysis: Examine structure of artifact for static qualities (e.g. complexity) Architecture analysis: Study fit of artifact into technical IS architecture Optimization: Demonstrate inherent optimal properties of artifact or provide optimality bounds on artifact behavior Dynamic analysis: Study artifact in use for dynamic qualities (e.g. performance)

3. Experimental	Controlled experiment: Study artifact in controlled environment for qualities (e.g. usability) Simulation: Execute artifact with artificial data
4. Testing	Functional (Black Box) testing: Execute artifact interfaces to discover failures and identify defects Structural (White Box) testing: Perform coverage testing of some metric (e.g. execution paths) in the artifact implementation
5. Descriptive	Informed argument: Use information from the knowledge base (e.g. relevant research) to build a convincing argument for the artifact's utility Scenarios: Construct detailed scenarios around the artifact to demonstrate its utility

Application of the Design Science Research Guidelines

Hevner et al. applied their guidelines to specific exemplar research efforts, but we omit them. (We read Markus et al. (2002) and it seems to be a preliminary phase of design-science compared with this article. Their article may be more about human characteristics than the development of an artifact.)

Discussion and Conclusions

Hevner et al. continue their careful presentation and start philosophical debates

> on how to conduct IS research (e.g., positivism vs. interpretivism) have been the focus of much recent attention (Klein and Myers 1999; Robey 1996; Weber 2003). The major emphasis of such debates lies in the epistemologies of research, the underlying assumption being that of the natural sciences. That is, somewhere some truth exists and somehow that truth can be extracted, explicated, and codified. The behavioral-science paradigm seeks to create 'what is true'. In contrast, the design-science paradigm seeks to create 'what is effective'. While it can be argued that utility relies on truth, the discovery of truth may lag the application of its utility. We argue that both design-science and behavioral-science paradigms are needed to ensure the relevance and effectiveness of IS research. Given the artificial nature of organizations and the information systems that support them, the design-science paradigm can play a significant role in resolving the fundamental dilemmas that have plagued IS research: rigor, relevance, discipline boundaries, behavior, and technology (Lee 2000). (Hevner et al. 2004, p. 98)

Hevner et al. (2004) state:

> Information systems research lies at the intersection of people, organizations, and technology (Silver et al. 1995). It relies on and contributes to cognitive science, organizational theory, management sciences, and computer science. It is both an organizational and a technical discipline that is concerned with the analysis, constructions, deployment, use, evaluation, evolution, and management of information systems artifacts in organizational settings (Madnick 1992; Orlikowski and Barley 2001). (Hevner et al. 2004, p. 98)

Concerning the nature of design and behavioral research, Hevner et al. state:

> Within this setting, the design-science research paradigm is proactive with respect to technology. It focuses on creating and evaluating innovative IT artifacts that enable organizations to address important information-related tasks. The behavioral-science research paradigm is reactive with respect to technology in the sense that it takes technolo-

> gy as 'given'. It focuses on developing and justifying theories that explain and predict phenomena related to the acquisition, implementation, management, and use of such technologies. The dangers of a design-science research paradigm are an overemphasis on the technological artifacts and a failure to maintain an adequate theory base, potentially resulting in well-designed artifacts that are useless in real organizational settings. The dangers of a behavioral-science research paradigm are overemphasis on contextual theories and failure to adequately identify and anticipate technological capabilities, potentially resulting in theories and principles addressing outdated or ineffective technologies. We argue strongly that IS research must be both proactive and reactive with respect to technology. It needs a complete research cycle where design science creates artifacts for specific information problems based on relevant behavioral science theory and behavioral science anticipates and engages the created technology artifacts. (Hevner et al. 2004, p. 98)

They also propose a number of exciting challenges facing the design-science research community in IS. These problems still seems to be valid; i.e., the authors see something essential.

Review of Hevner et al. (2004)

This is an excellent article, because it contains design science and behavioral-science approaches (but this combination has also caused confusion). The article is well-written. We still like to pay attention an aspect that is often forgotten. Namely an inportance of a research problem, it concerns *contributions* of both behavioral science and design science in IS research. They must be *useful*.

Although we much appreciate this article, we have some comments:

1. The authors themselves write that their

> definition of IT artifacts is both broader and narrower than those articulated above. It is broader in the sense that we include not only instantiations in our definition of the IT artifact but also the constructs, models, and methods applied in the development and use of information systems. However, it is narrower in the sense that we do not include people or elements of organizations in our definition nor do we explicitly include the process by which such artifacts evolve over time. (Hevner et al. 2004, p. 82)

   This technology-orientation can create some difficulties where people and their behavior play an important role. A bookkeeper once asked, "Why do programmers try to solve all the problems"? She then asked, "Why don't programmers automate the easiest problems and leave the most difficult ones to people (experts)"?
2. Guideline 6 (Design as a search process) is explained as follows: "The search for an effective artifact requires utilizing available means to reach desired ends while satisfying laws in the problem environment" (see Table 8). We don't think the term "search" is the best possible. We would emphasize development more than searching, because normally, we do not yet have a great number of components (sub-programs, etc.) among which to search, but we must create a component from scratch.
3. Hevner et al. state concerning Guideline 3 (Design evaluation) that:

> evaluation of a designed IT artifact requires the definition of appropriate metrics and possibly the gathering and analysis of appropriate data. IT artifacts can be evaluated in terms of functionality, ..., fit with the organization, and other relevant quality attributes. (Hevner et al. 2004, p. 85)

The evaluation of the fit between an IT artifact and the organization is similar to the evaluation between a representation of IS and IS itself, because the latter "represents some part of the world that a user and other stakeholders must understand" (cf. Burton-Jones and Grange 2013, p. 632).
Østerlie and Monteiro (2020) draw on a four-year case study of offshore oil and gas production. They apply a representation theory to that production by using digital technologies. They examine "organizationally real" digital representations and compare them with reality. (Obs. Hevner et al. published their study years before Burton-Jones and Grange and much earlier than Østerlie and Monteiro.)
Recently, Baskerville et al. (2020) state (p. 509):

> As information systems (IS) academics, we have traditionally viewed the purpose of an information system as being to model and reflect reality. The information system is a reflection of reality and the information it contains is a purposeful representation of the real world. In this classical view of an information system, data models provide a formal means of representing information about the world.
>
> They "believe that this classical view of an information system is increasingly obsolete". They "explain how an ontological reversal is underway. In this reversal, the real world becomes a purposeful product of the digital world. Reality becomes a reflection of our models in the digital world. This reversal has profound implications for the IS field."

4. March and Smith (1995) and Hevner et al. (2004) presented a technological innovation. Liedtka (2020) presented many social innovations that can be combined with technical ones.
5. In Figure 2, Hevner et al. (2004) under heading 'IS Research' present main functions [Develop/Build (top) and Justify/Evaluate (down)]. But readers seem to have difficulties to differentiate behavioral science (Develop and Justify) and design science (Build and Evaluate), they are often confused.

Our interpretation

Our purpose is to give our interpretation of Hevner et al.'s (2004, p. 78) view "two complementary but distinct paradigms, behavioral science and design science". We see a construction process. and its purpose is to achieve a movement from the initial state to the target or goal state (Figure 3).

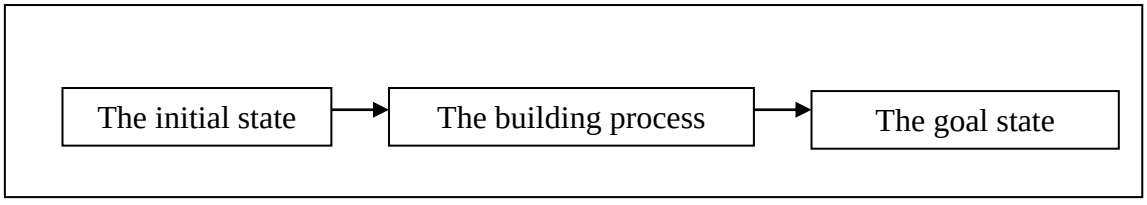

Figure 3 The building process

When we describe the initial and goal states, we use behavioral science, and when we implement the building process, we use design science. The descrip-

tions of the initial and goal states can be kept as instances of a certain behavioral theory. The former is an instance of a certain theory about where we are at the beginning of the construction process. The goal state is not yet realized. i.e., it is a utopia which could be achieved. For example, when we previously had a certain manual system, say, paying for support in social care, we must describe the initial state of the system for understanding. When we ask software houses to build a computer-supported version, we must describe the system's goal state. In both description tasks (initial and goal), we could utilize a certain theory, and those descriptions are instances of a theory. The initial and goal states can be considered an activity (Figure 4).

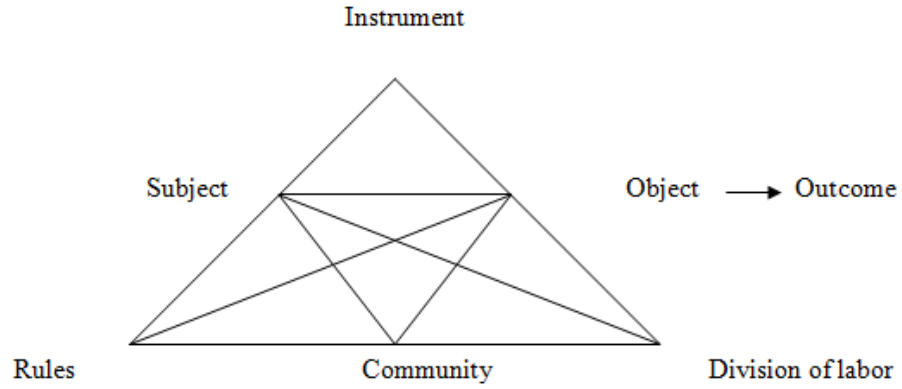

Figure 4 An activity (Engeström 1987)

Human activity consists of six components. Engeström (1987, pp. 76-78) describes it as a transition from animal to man where the subject-object-community triangle is enlarged with three differentiating abilities of man: 1) using instruments in elaboration of objects, 2) organizing work by division of labor and 3) using rules, e.g., language in communication and co-operation. We apply the idea of activity to the initial and goal states in Figure 5.

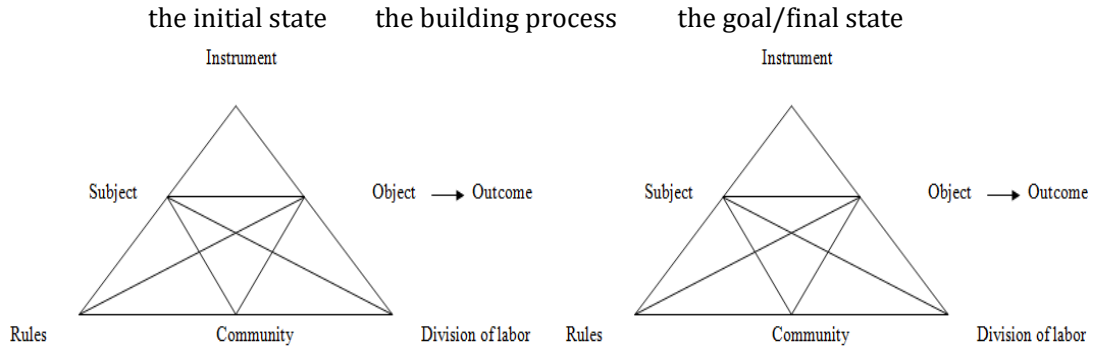

Figure 5 Transition from the initial state to the goal or final state

According to March and Smith (1995) and Hevner et al. (2004), in a positive case, the goal state can be achieved by constructing a new artifact based on technology. Sometimes, researchers and /or practitioners do not achieve the

goal state but achieve the lower final state that is not the desired goal. However, in practice the final state can be mostly achieved and accepted. By the term "lower," we mean a value of the goal function (Järvinen 2007b) under which all kinds of different interests (from different stakeholders) can be collected. It is assumed that a goal function is higher in the final state and lower in the initial state. The goal function is a utility metric.

A subject often uses an instrument in the elaboration of objects in the initial state, and in information systems, an instrument normally is an IT artifact. A researcher improves a current IT artifact or buys a new one or develops it himself, etc. to achieve the goal or final state.

(We continue this discussion in connection with action research in the next section.)

2.5 Canonical action research

Davison, Martinsons and Kock (2004) and later Davison, Martinsons and Ou (2012) developed five principles and many criteria for canonical action research (CAR). They propose a theory for CAR and with it, they are at a forefront of research. In the latter article the authors demonstrated how their five principles and many criteria were applied to two firms.

Davison et al. (2004)

Introduction

Davison, Martinsons and Kock state:

> In recent years, the publication of action research (AR) articles in the information systems (IS) domain has become more frequent, with a number of theoretical and applied contributions. ... AR has been criticized for its lack of methodological rigor (Cohen & Manion, 1980), its lack of distinction from consulting (cf. Avison, 1993) and its tendency to produce either 'research with little action or action with little research' (Dickens & Watkins, 1999, p. 131).
>
> This article addresses these criticisms by developing a set of interdependent principles and associated criteria that researchers and reviewers can use both to ensure and to assess the rigor and relevance of canonical action research (CAR) – one of the more widely practiced and reported forms of AR in the IS literature. The term 'canonical' is used to formalize the association with the iterative, rigorous and collaborative model developed by Susman and Evered (1978). (Davison et al. 2004, p. 65)

Rigor and relevance

Davison et al. define "rigor" as follows:

> While AR in general has been praised for the relevance of its results (e.g. Baskerville & Wood-Harper, 1996), it has also been criticized as lacking rigor (e.g. Cohen & Manion, 1980). Consequently, it is useful to clarify the meaning and importance of both rigor and relevance. Merriam-Webster's Collegiate Dictionary (http://www.m-w.com) defines rigor in various ways, the most relevant to our purpose being 'strict precision' and 'exact-

ness'. Rigor has also been referred to as 'the correct use of methods and analyses appropriate to the tasks at hand' (Benbasat & Zmud, 1999, p. 5), which implies the existence of a context that will enable one to determine what is correct and appropriate. (Davison et al. 2004, p. 66)

AR and CAR

The authors explain:

> The origins of AR can be traced to the work of Lewin (1947a,b) and researchers at the Tavistock Clinic (e.g. Trist & Bamforth, 1951). The evolution of AR is detailed in Baskerville & Wood-Harper (1998) and Baskerville (1999). A seminal contribution to the AR literature was made by Susman & Evered (1978) with a formally expressed cyclical process model. In this article, we extend their work in an explicit and prescriptive fashion. (Davison et al. 2004, p. 67)

Davison et al. write that their

> more modest intention is to improve the quality of CAR studies by providing practical guidance for both researchers and reviewers. Nevertheless, we do not wish to establish CAR as the preferred or pre-eminent form of AR. We encourage researchers working in other areas of the AR field to develop appropriate principles and guidelines for other forms of AR in the future. (Davison et al. 2004, p. 68)

Principles of CAR

Davison et al. explain:

> CAR aims to address organizational problems while at the same time contributing to scholarly knowledge. A set of principles would be useful to achieve these potentially conflicting aims and thus promote the rigor and relevance of CAR. The principles presented here are drawn from the AR literature as it has developed since the late 1940s in the social sciences and our own extensive experience with CAR. (Davison et al. 2004, p. 69)

The authors clarify:

> In addition to the principles, we identify specific criteria to help assess if each of the principles is being upheld in a particular CAR project. These criteria may be used by action researchers as they plan and conduct a project, and by reviewers (and readers) to assess a CAR project report. Each criterion is expressed in the form of a question of the type "Has something been done?". (Davison et al. 2004, p. 69)

Davison et al. (2004) propose the following five principles for CAR:

1. the Principle of the Researcher-Client Agreement (RCA);
2. the Principle of the Cyclical Process Model (CPM);
3. the Principle of Theory;
4. the Principle of Change through Action; and
5. the Principle of Learning through Reflection.

The Principle of the Researcher-Client Agreement (RCA)

According to Davison et al.:

> The RCA is the guiding foundation for an AR project (Foster, 1972). However, in order for the RCA to be effective, it is necessary that the client understands how CAR works and what its benefits and drawbacks are for the organization. Achieving this understanding may require a process of knowledge transfer (from researcher to client). The agreement should contain mutual guarantees for behaviour in the context of the project. A well-constructed RCA should provide a solid basis for building trust among the various stakeholders and contributes to the internal validity of the research. The agreement helps to promote a spirit of shared inquiry, by having clients contribute as the researcher determines goals, plans actions, implements changes and assesses the outcomes of those changes. Adherence to the Principle of the RCA may be assessed using the criteria listed in Table 1 [Table 10]. Ideally these criteria will be met before a project is formally initiated, i.e. during pre-project discussions between researcher and client. However, in reality they may well be more emergent, with variations in procedures developing as the project progresses. (Davison et al. 2004, p. 69-70)

Table 10 Criteria for the RCA (Davison et al. 2004, p. 70)

1a	Did both the researcher and the client agree that CAR was the appropriate approach for the organizational situation?
1b	Was the focus of the research project specified clearly and explicitly?
1c	Did the client make an explicit commitment to the project?
1d	Were the roles and responsibilities of the researcher and client organization members specified explicitly?
1e	Were project objectives and evaluation measures specified explicitly?
1f	Were the data collection and analysis methods specified explicitly?

The Principle of the Cyclical Process Model (CPM)

Davison et al. describe:

> When an initial RCA has been established, it is appropriate for the action researcher to commence work on the project. His or her activities will typically be informed by and designed to follow a CPM. Susman & Evered (1978) originally proposed a model with the following five stages: diagnosis, planning, intervention, evaluation and reflection. Subsequently, Kemmis & McTaggart (1988) suggested that the model should take the form of a spiral, not a cycle, with the intervention moving ever closer to the core of the organizational problem with each iteration. More recently, McKay & Marshall (2001) outline a model that includes two cycles running in tandem: one addresses the client's problem solving interest while the other addresses the researcher's scholarly interest. The CPM presented in Figure 1 [Figure 6] builds upon these various perspectives. The extent to which the Principle of the CPM is reflected in a project can be described by the adherence to seven criteria (see Table 2 [Table 11]). (Davison et al. 2004, p. 72)

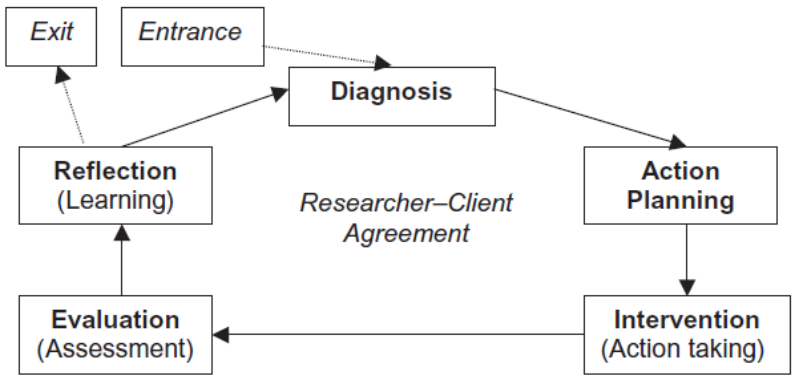

Figure 6 CAR process model (Davison et al. 2004, p. 72)

The authors added "entrance" and "exit" to the original CAR model (Susman and Evered 1978). Davison et al. later present the importance of the entrance and the exit.

Table 11 Criteria for the CPM (Davison et al. 2004, p. 72)

2a	Did the project follow the CPM or justify any deviation from it?
2b	Did the researcher conduct an independent diagnosis of the organizational situation?
2c	Were the planned actions based explicitly on the results of the diagnosis?
2d	Were the planned actions implemented and evaluated?
2e	Did the researcher reflect on the outcomes of the intervention?
2f	Was this reflection followed by an explicit decision on whether or not to proceed through an additional cycle?
2g	Were both the exit of the researcher and the conclusion of the project due to either the project objectives being met or some other clearly articulated justification?

The Principle of Theory

The authors present the differing views on theory as follows:

> McKay & Marshall (2001) contend that AR without theory is 'not research'. They insist that a clearly articulated theoretical framework must be imposed on the phenomenon of interest. Others disagree, believing that the application of theory, particularly at the very start of a project, may be counter-productive (cf. McTaggart, 1991; Bunning, 1995).
>
> With respect to theory development, Heller (1993) observed that 'there are still very many social issues for which no paradigmatic model and no appropriate evidence exists. In those circumstances, a research phase, wherever possible with the people who experience the problems, has to precede action' (cf. Pasmore & Friedlander, 1982). Our third principle highlights the role of theory in CAR. We acknowledge that a CAR project may begin with theory-free action learning. However, akin to the traditional scientific method, the diagnostic stage provides a starting point of comparison for the post-implementation evaluation. ... Changes to theory typically take place in the reflection stage of the CAR process and lead the project into an additional process cycle. The essential role of theory in CAR, which helps to distinguish it from action learning, is reflected in the criteria that appear in Table 3 [Table 12]. (Davison et al. 2004, p. 73)

Table 12 Criteria for the principle of theory (Davison et al. 2004, p. 74)

3a	Were the project activities guided by a theory or set of theories?
3b	Was the domain of investigation, and the specific problem setting, relevant and significant to the interests of the researcher's community of peers as well as the client?
3c	Was a theoretically based model used to derive the causes of the observed problem?
3d	Did the planned intervention follow from this theoretically based model?
3e	Was the guiding theory, or any other theory, used to evaluate the outcomes of the intervention?

The Principle of Change through Action

Davison et al. characterize the fourth principle as follows:

> The essence of CAR is to take actions in order to change the current situation and its unsatisfactory conditions (cf. Curle, 1949; Hult & Lennung, 1980; Eden & Huxham, 1996). The fourth principle reflects this essence and the indivisibility of action and change, with intervention seeking to produce change. A lack of change in the unsatisfactory conditions suggests that there was no meaningful problem, that the intervention failed to address the existing problem(s), or that the existing situation could not be altered because of political or practical obstacles that were neglected when the RCA was established. (Davison et al. 2004, p. 75)

The authors present:

> The criteria related to the Principle of Change through Action are shown in Table 4 [Table 13]. In order for meaningful action and change to occur, the researcher and the client must have a common understanding of the organizational situation which doubles as the research context (cf. Cunningham, 1993). (Davison et al. 2004, p. 75)

Table 13 Criteria for the principle of change through action (Davison et al. 2004, p. 75)

4a	Were both the researcher and client motivated to improve the situation?
4b	Were the problem and its hypothesized cause(s) specified as a result of the diagnosis?
4c	Were the planned actions designed to address the hypothesized cause(s)?
4d	Did the client approve the planned actions before they were implemented?
4e	Was the organization situation assessed comprehensively both before and after the intervention?
4f	Were the timing and nature of the actions taken clearly and completely documented?

The Principle of Learning through Reflection

The authors describe the fifth principle as follows:

> Lau (1997) asserts that the explicit specification of learning is the most critical activity in AR. The rationale for our Principle of Learning through Reflection stems from the multiple responsibilities of the action researcher: to clients and to the research community. This is consistent with the common call for research reports to specify the implications for both practice and (further) research. Clients will focus on practical outcomes while the research community will be interested in the discovery of new knowledge. Practical progress and the advancement of knowledge both result from considered reflection and learning. (Davison et al. 2004, p. 76)

The criteria for this principle are in Table 14.

Table 14 Criteria for the principle of learning through reflection (Davison et al. 2004, p. 76)

5a	Did the researcher provide progress reports to the client and organizational members?
5b	Did both the researcher and the client reflect upon the outcomes of the project?
5c	Were the research activities and outcomes reported clearly and completely?
5d	Were the results considered in terms of implications for further action in this situation?
5e	Were the results considered in terms of implications for action to be taken in related research domains?
5f	Were the results considered in terms of implications for the research community (general knowledge, informing/re-informing theory)?
5g	Were the results considered in terms of the general applicability of CAR?

Applying the principles

Davison et al. (2004) demonstrate how principles and criteria could be used to assess and to conduct CAR. They apply their principles and criteria to the Olesen and Myers' (1999) CAR paper. The authors go through the paper by principles. They also published Myers' response to the critique.

Discussion

The authors conclude:

> Action research, as a method of inquiry, is founded on the assumption that theory and practice can be closely integrated by learning from the results of interventions that are planned after a thorough diagnosis of the problem context. The five principles elicited here are intended to help assure the quality of CAR practice, reporting and reviewing. Adherence to these principles will help canonical action researchers to balance their commitments to organizational and research community stakeholders and to address the previously mentioned criticisms of AR by improving both its rigor and its relevance. These two attributes are critical because they confirm the validity-in-practice of the investigation as well as the validity-in-application of knowledge that informs and emerges from the investigation. (Davison et al. 2004, p. 81-82)

Davison et al. (2004) then consider how the five principles of CAR contribute to rigor and relevance. We present our review after the following improvements.

Davison et al. (2012)

Davison et al. describe two theories, focal and instrumental, as follows:

> A focal theory provides the intellectual basis for action-oriented change in a CAR (canonical action research (Susman and Evered 1978)) project. Examples of focal theories include the theory of planned behavior (Ajzen 1991), adaptive structuration theory (DeSanctis and Poole 1994), and punctuated equilibrium theory (Gersick 1991).
>
> In contrast, an instrumental theory is used to explain phenomena (Angeles 1992), including those processes and tools that are used to establish and verify focal theories. Action researchers and their clients use instrumental theories to facilitate specific activities, especially diagnosis, planning and evaluation. Although other terms such as micro-theory (Markus et al. 2002), theory for analyzing (Gregor 2006), and even analytical tool have been used previously to denote this kind of theory, our use of the term instrumental theory reflects a belief that the theory is instrumental in facilitating a rigorous CAR process. (Davison et al. 2012, p. 765-766)

The original set of five principles and 31 criteria were published as part of the Davison et al.'s article in *Information Systems Journal* in 2004. They are now revised and supplemented with criteria that are clearly indicated. The numbering of the principles and criteria follows the pattern used in Davison et al. (2004).

We concentrate on the principles and criteria that guide CAR research generally. We also consider instrumental and focal theories applied to two Chinese organizations. We consider only how some changes in criteria have been made since 2004. The new criteria can be found in Davison et al. (2012, Appendix A, pp. 785-786):

The five principles were retained. The criteria for Principles 1, 4 and 5 are the same in 2004 and 2012. Principle 2 received five supplementary criteria. The only changes that happened between 2004 and 2012 concern Principle 3. Three were revised, and seven are new.

P2: The principle of the cyclical process model

Original Criteria

C2a ... C2g

Supplementary Criteria

C2h How was the independent diagnosis of the organizational situation conducted?
C2i Which instrumental theories did the researcher use?
C2j How were these theories selected?
C2k How did these theories support the identification of the focal theory used to guide the changes?
C2l Post-intervention, did the researcher reflect on the instrumental theories used and their suitability?

P3: The principle of theory

Original Criteria

C3a Were the project activities guided by a theory or set of theories?
C3b Was the domain of investigation, and the specific problem setting, relevant and significant to the interests of the researcher's community of peers as well as the client?
C3c Was a theoretically based model used to derive the causes of the observed problem?
C3d Did the planned intervention follow from this theoretically based model?
C3e Was the guiding theory, or any other theory, used to evaluate the outcomes of the intervention?

Revised Criteria

C3c Was an instrumental theory used to derive the causes of the observed problem?
C3d Did the planned intervention follow from this instrumental theory?
C3e Was the focal theory used to evaluate the outcomes of the intervention?

Supplementary Criteria

C3f Did a focal theory emerge from the situation or during the problem diagnosis?
C3g Was this focal theory acceptable to both client and researcher?
C3h What role did instrumental and focal theories play with respect to the diagnosis and the action planning?
C3i Were these theories evaluated for their applicability to the organizational context, considering current organizational practices?
C3j Did both the researcher and the client undertake this evaluation?

C3k Were theoretical explanations for the current organizational problem situation evaluated and reflected upon?
C3l Did the researcher reflect on the focal theory used and its ability to predict the change outcomes?

Addition

Cecez-Kecmanovic et al. inform that

> Wong and Davison (2018) suggest that canonical action research can be enhanced by inserting a new pre-diagnostic stage in which the researchers devote considerable effort to learn about the organization, its people and culture, and its language and jargon, in order to ensure that when they do start to interact with employees they are fully cognizant of what they are seeing and hearing. (Cecez-Kecmanovic et al. 2020, p. 257)

Review of Davison et al. (2004, 2012)

The 2004 and 2012 principles and criteria were well designed. In addition, the authors were the first to focus on theory in connection with AR.

Two theories, focal and instrumental seem to correspond two theory types: 1) what is a part of reality (truth) and 2) what is a utility of a new system, respectively. Although Davison et al. do not emphasize this pair, it is important, when methodology of action research is related to other ones. It supports a view that design and action science are similar.

The sets of principles, criteria, focal and instrumental theories are tested in two real-life cases. Davison et al. (2012) describe that (p. 766):

> The planned changes in this particular project were underpinned by two specific instrumental theories—the value shop and the balanced scorecard—and three different focal theories—transaction cost economics (TCE) (Williamson 1975), transactive memory theory (TMT) (Wegner 1987), and an emerging theory of knowledge sharing.

For thee focal theories (TCE, TMT and an emerging theory of knowledge sharing), it is interesting to ask: Are three theories used in a confirmatory or exploratory way. Analysis of Davison et al. (2012) shows that in this article, researchers proposed focal theories (TCE for Eastwei, TMT for RuderFinn and a knowledge sharing theory for both), and in a confrmatory way. Then, researchers considered an object under study through focal theories, and this object seems to behave according to theories. It is also possible that a study situation is not so simple and stable, and then, reseachers must perform a case study to find what is an explored part of reality. Both ways (exploratory and confirmatory) to use focal theories will help in canonical action research.

In two Chinese cases, the value shop and the balanced scorecard (BSC) were used as instrumental theories. BSC emphasizes many different economic factors or utility criteria. The value shop contains five main generic activities (Problem finding and acquisition, Problem solving, Choice of problem solution, Execution of solution, and Control and evaluation) that are similar as phases of problem solving.

Although we much appreciate these articles, we have some comments about the content:

1. In our paper (Järvinen 2007a) we show that AR and design science (DC) are similar. Therefore, we apply Figure 7. The purpose of the construction process is to achieve a transition from the initial state to the goal state.

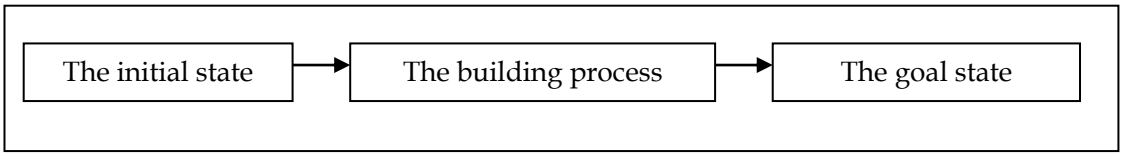

Figure 7 The building process (also in Hevner et al. 2004)

We like to emphasize this movement in AR, too.

2. Schneberger et al. (2009) state that

> all theories are not created, used, or researched equally – and some may be better suited for specific applications or situations. Academics, for example, tend to stress scientific rigor in hypotheses, measurement, and analysis so that theories can be used in the widest practical range of situations. Practitioners, on the other hand, might use 'hunches' as hypotheses, use 'seat of the pants' assessments, and focus solely on the situation at hand – therefore stressing relevance over rigor. In everyday practice, however, most theories are somewhere in between, forming a continuum of theories depending on their internal characteristics and external use. In this sense, a wide range of theory definitions from philosophical laws to simple suppositions can be accommodated along the continuum – and yet be equally useful in practice. We label the two ends of that theoretical continuum as 'big T' theories and 'little t' theories. (Schneberger et al. 2009, p. 54)

Academics often receive 'little t' theories from practitioners when they are co-operating in CAR. Sanchez and Heene (1997) also presented support for a similar view.

3. The authors in Davison et al. (2012) use two specific instrumental theories: The value shop and the balanced scorecard (BSC). The former contains a general problem-solving steps and will be applied to every case. Concerning the latter, Nørreklit (2003, p. 592) showed that ... "there is no cause-and-effect relationship between some of the suggested areas of measurements in the BSC." Perhaps, a need for an instrumental theory must be rethink.

Our interpretation

In Section 2.4, we considered the development of the system from the initial state to the goal or final state (in Figure 8).

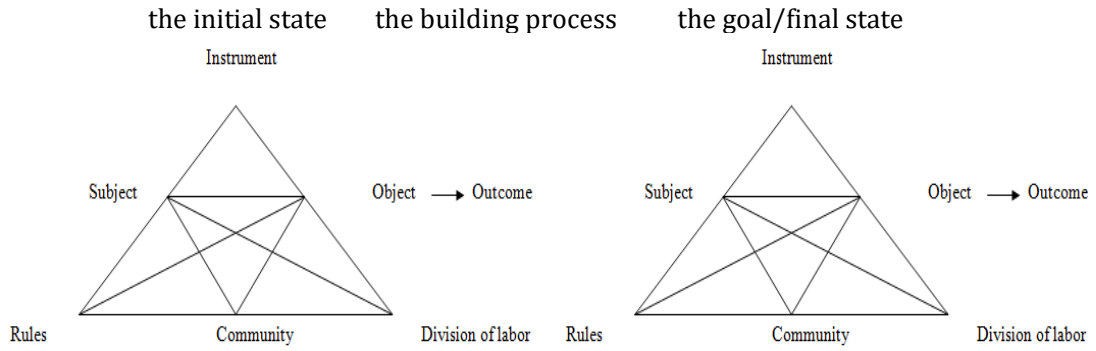

Figure 8 Transition from the initial state to the goal/final state

We assume that we can apply the resource-based view (RBV); i.e., there are physical, social and informational resources. (The fourth resource is financial, i.e., money with which we can buy the other three types.) Material, technology (IT etc.) are physical resources, people are social resources, and data, information and knowledge are informational resources.

Re-analysis

We re-analyze two examples presented by Davison et al. (2012) and show another potential solution. Davison et al. describe:

> Our enhancement of CAR has emerged from a extended knowledge sharing project that we undertook with two public relations (PR) firms in China: Eastwei (www.eastwei.com) and RuderFinn (www.ruderfinnasia.com). ... Both firms also provide a similar range of media-related services to their clients, primarily large multinational corporations that need to develop and maintain PR initiatives in China. (Davison et al. 2012, p. 771)

Davison et al. (2012) first perform action research in Eastwei and then in RuderFinn. We emphasize that the research objects are similar.

Concerning Eastwei, Davison et al. state that their guiding research question was:

> How do Chinese employees make use of technology to manage knowledge? The authors found that most knowledge sharing was because of Guanxi restricted to members of work teams. Team members used instant messengers (IM) in their communication and messages were automatically archived. (Davison et al. 2012, p. 774)

Davison et al. (2012) made some minor improvements is knowledge sharing in Eastwei.

The authors' second action research project was conducted at RuderFinn. Davison et al. (2012) take value shop theory as the instrumental theory and transactive memory theory as focal theory. In this context, we believe IT would support knowledge management. The authors state that transactive memory refers to the knowledge of "who knows what". They then refer to a fact: This meta-knowledge is a basic requirement of the distributed knowledge system.

Davison et al. (2012) emphasize that instrumental and focal theories play an important role in the authors' two action research projects. We agree that the

theories helped communication via perspective making and perspective taking between researchers and practitioners (Boland and Tenkasi 1995). Our view, however, slightly differs from their view. According to our view, action research and design research are similar. Thus, we believe that IT and an improvement in its use in Chinese cases helped knowledge sharing, although it happens mainly in teams, not among all the participants.

On social issues

Davison et al. (2004) write that action research is needed to solve social issues. We are interested in how social issues are solved and how theory plays a central role. Solving this kind of problem means that an organization or a unit is moved from the initial state to the goal or final state mainly using social resources. People in the goal or final state have been predicted to behave in another way that will solve the problem. We defined *goal function* as "under which all kinds of different interests can be collected" (Järvinen 2007b, p. 1392). We hope that different parties express their own interests and these are in one way or other collected and combined.

In Section 2.4 (design science), a system had two states, an initial state and goal or final state. When action research is similar to design research (Järvinen 2007a), then in design science and in action research a certain kind of "state theory" can describe the initial and final states. The "state theory" describes a normal production of products or services. A production and/or service then functions *continuously*. Our message is that a "state theory" can be someone from focal theories, and an improvement in a goal function can sometimes be based on also using IT technology in activities, i.e., knowledge sharing.

In design research implemented as March and Smith (1995) propose, a new technical artifact causes a change from the initial state to the final state. The change happens only *once*. Davison et al. (2012) took BSC and the value shop for instrumental theories. But do they much help researchers, when they like to move an object from the intial state to the goal state? A problem solving nature, e.g., value shop as an instrumental theory can raise a question: Do we really need any instrumental theory?

In action research a change is often based on a change in social resources (it can also be based on other types of resources, technical and/or informational). We take Huy (2001) as an example of a change in social resources. Huy

> derived four ideal types of intervention approaches, which I [Huy] label commanding (to change formal structures), engineering (to change work processes), teaching (to change beliefs), and socializing (to change social relationships) (See Table 1 [Table 15].) (Huy 2001, p. 603)

Huy continued:

> Ideal types are formed as the 'one-sided accentuation of one or more points of view and by the synthesis of a great many diverse, more or less present and occasionally absent concrete individual phenomena' (Weber 1904, 90). (Huy 2001, p. 603)

Table 15 Content of change and associated change intervention ideal types (Huy 2001, p. 604)

Tangibility of Content	Emphasis of Change Literature	
	Episodic Change	**Continuous Change**
Tangible	Formal structures (changed through commanding)	Work processes (changed through engineering)
Intangible	Beliefs (changed through teaching)	Social relationships (changed through socializing)

Huy (2001) reports a literature review in which he found *tangible* and *intangible* content of change. For tangible, we found a differentiation between *formal structures* and *work processes;* and for intangible, *systems of shared beliefs* and *social relationships*.

In Table 15, there are alternatives for how changes are obtained through commanding (to change formal structures), engineering (to change work processes), teaching (to change beliefs) and socializing (to change social relationships). Behind every possibility is a different "change" theory. When commanding, or engineering, or teaching or socializing is performed only once (regardless of whether change happens rapidly or slowly), this performance will cause the desired change from the initial state to the goal or final state.

An example

Karjalainen (2010) describes in his dissertation:

> This study investigates the largest transition in Finland to an open source office suite and to an open standard for office documents. The IT environment of the open source OpenOffice.org migration involves more than 10 000 workstations in the Finnish Ministry of Justice and its administrative sector. (Karjalainen 2010, Abstract)

The ministry moved from Microsoft Office software to Open Office software. He acted as a project leader (2003-2010), and the transition occurred from 2007 on.

Karjalainen first became an expert in programming and for some years, he was responsible for software education at the University of Tampere, since Professor Reino Kurki-Suonio left for another university in 1980. Karjalainen later on moved to practice, and he then worked guiding practitioners in software problems.

He wanted to register his big project as a dissertation and then wanted to concentrate on software changes because of his background. But his responsibility as a project leader and champion required he take care of the social side, too. Fortunately, he recorded the performance of supporting tasks such as training in addition to software change in his thesis. Therefore, we also consider this project action research. Karjalainen states:

> Cost savings amounted to more than 4 M€ during the 6-year period 2006-2011. (Karjalainen 2010, p. 146)

This savings (4 M€) also motivated the management of the Finnish Ministry of Justice and acted as goal factor to measure utility.

Some figures in his dissertation describe his effort in training:

> The author of this study was the most active instructor giving altogether 245 training sessions. (Karjalainen 2010, p. 170)

He and his colleagues wrote many (at least six) guides (manuals) for Open Office, and a pilot study was also organized (2005). It seems that teaching and socializing from Huy (2001) are used in the social change required for migration. Karjalainen then states that he was surprised how satisfied people were with the training. They said that it was also important that teachers considered general IT basics in addition to how to use the new Open Office. The possibility of meeting co-workers and change experiences are also mentioned.

To summarize our own thinking:

1. Design science (DS) and action research (AR) are similar.
2. In DS and AR projects, there are the initial state and goal or final state.
3. Both states can be described, and researchers can use a certain focal theory in their description.
4. A goal function measuring the goodness of a new system can be evaluated in both states.
5. A change from an initial state to a goal or final state takes place once.
6. In the initial and goal or final states, normal production and/or service occurs repeatedly, and the production and/or service undergoes a certain transformation.

2.6 Conceptual research

Hirschheim was senior editor of the *IS Research Perspectives* Section of the *Journal of the Association for Information Systems* (*JAIS*). He was asked about "the kinds of papers that are or are not appropriate", how in this section was decided what is and is not appropriate, and, specifically, how to evaluate the submissions received. Hirschheim gives guidelines for papers submissions that are conceptual in nature. Hirschheim's guidelines are structured in seven areas: "(A) introduction, (B) content, (C) presentation and structure, (D) theoretic foundation, (E) data analysis / interpretation / argumentation, (F) results, and (G) conclusions."

Hirschheim (2008)

Overview of the IS Research Perspectives Section

Hirschheim writes that:

> The IS Research Perspectives is a special section of JAIS whose overall goal is to publish articles that address critical issues that shape the IS research tradition, carry an underlying message for the field's research mission, and are thought-provoking and insightful. (Hirschheim 2008, p. 433)

He characterizes IS as adhocracy (Banville and Landry 1989). He also views that:

> the IS Research Perspectives section can help: by providing a forum where this debate can occur. We believe that the IS discipline already has the motivation for engaging in such discussions, but needs direction in addressing the communication deficit. We believe we offer one such vehicle. (Hirschheim 2008, p. 433)

Hirschheim emphasizes rigor in submitted papers. He also states:

> We invited the IS academy to submit articles taking a stance on any debatable issue of interest to our community and with lasting scholarly value. But we especially welcomed submissions that attempted to address this communication gap. We encouraged articles focusing on high-level, institutional analyses of the field (e.g., future of the discipline), theoretical concerns, methodological and philosophical issues, as well as interdisciplinary analyses. In addition, we invited articles suggesting how we should assess our journals, provided the authors went beyond simple atheoretical postures and suggested how methodologies could be justified and, ideally, how their work fit into a larger picture of theory development within scientific communities. So far, we have been pleased with the response. The number of submissions to the IS Research Perspectives section has been growing annually, and we have informally heard that most of you value the papers published in this section. (Hirschheim 2008, p. 434)

He motivates researchers to submit not only papers focusing on the typical (traditional) research article genre. As for Hirschheim (2008), this means "empirical and mostly positivist submissions". He also calls for papers focusing on how to review conceptual or philosophically motivated, rather than empirical, articles. He continues:

> Evaluating such papers is challenging, not so much because they are more complex, but because they generally do not fit the mold of empirical research articles to which we are more accustomed and later ... Part of the reason for my commentary piece is to show that reviewing such papers requires a broad critical eye to ensure that the accepted papers do make a significant contribution to knowledge. (Hirschheim 2008, p. 434)

Reviewing Issues

Hirschheim first refers to the following:

> Many scholars feel that reviewing papers is more an art than a science. In the seminal book Publishing in the Organizational Sciences, Cummings and Frost (1995) attempt to address questions such as: What makes a good review? How should one undertake a review? What should one look for in a paper? How does one assess the level of contribution of a paper? How novel is the contribution? Does the paper successfully build on what has been done in the past? More fundamentally, how does one distinguish between

> a good paper and a bad one? Although it is not necessarily easy to ascertain a good paper from a bad paper, there are some accepted guidelines to help. Unfortunately, many of these guidelines work for knowledge claims that are based on empirical data. But what if the claims are conceptual and focus more on offering new ways to think about a phenomenon? How does one judge such claims? (Hirschheim 2008, p. 435)

The author explains:

> Conceptual papers emphasize assumptions, premises, axioms, assertions, etc.; and these need to be made as explicit as possible so they can be evaluated. But how should they be evaluated? One useful framework is the one offered by the British philosopher Stephen Toulmin (1958) in The Uses of Argument. Using Toulmin's framework, one can assess the strengths and weaknesses of the arguments used by a paper's authors. For Toulmin, there are six aspects of an argument: Three necessary components and three optional ones. The necessary components are claims, grounds, and warrants. (For this paper, I am going to omit Toulmin's optional argument properties, i.e., qualifiers, rebuttal, and backing.) Claims refer to the statement or thesis that the authors are asking the reader to accept as true. An example might be the assertion that for an information system to be successful, one needs to have user participation in its design. The grounds (or support) is the method of persuasion used by the authors and is comprised of data plus the reasoning behind the claim. Fundamentally, this is the evidence or grounds by which the claim is supported or justified. The support for a claim may take the form of facts and statistics, mathematical proofs, expert opinion, examples, explanations, prior literature, and logical reasoning. In the case of the claim for user participation, the authors might cite a variety of research articles that show user participation leading to successful systems. A warrant links the data (grounds) to a claim. Ostensibly, warrants are the assumptions or presuppositions underlying the argument. They are often unstated or implied, and typically not debated. In the case of user participation, a warrant might be the belief that organizations want to build successful systems. The job of the reviewer is to assess whether the claims made by the authors are: (1.) understandable (intelligible); (2.) substantiated (believable); and (3.) significant (makes a worthy contribution to knowledge). That is what critical reviewing is all about. (Hirschheim 2008, p. 435)

Hirschheim emphasizes:

> Papers mature into worthwhile products only through critical review as many experienced eyes pore over them. Outside reviewers play a vital role here. They help the paper's authors better craft their arguments, their thinking, their way of presenting evidence, their conclusions, etc. Reviewers must, therefore, guard against narrow-mindedness. They must be open to new ideas: new ways of thinking, new ways of presenting evidence, new insights, and the like. This is even more important when reviewing conceptual papers. They also have to guard against their egos taking over the review process. No authors want to have reviewers write derogatory remarks about their paper or to have the reviewers dictate what the paper says. Reviewers need to be diplomatic and constructive, yet clear and concise. While the onus is on the authors to make their arguments intelligible and believable to the reader, the reviewer should be polite and constructive no matter how bad he/she feels the paper is. (Hirschheim 2008, pp. 435-436)

The author introduces that:

> in the following, I offer a rough set of guidelines to get started. They are structured in seven areas: (A) introduction, (B) content, (C) presentation and structure, (D) theoretic foundation, (E) data analysis/interpretation/argumentation, (F) results, and (G) conclusions. Many of these guidelines are general and relate to any type of paper being reviewed. Others – especially sections (D), (E) and (F) – are focused more on conceptual papers. (Hirschheim 2008, p. 436)

He also adds a long list of questions after each area.

A) Introduction

Hirschheim describes this subsection as follows:

> The introduction sets out the motivation and the purpose of the paper. It tells the reader why he/she should be interested in investing the time to read the paper. It sets up the claims that the paper will be making. (Hirschheim 2008, p. 436)

B) Content

The author states that:

> Content refers to the specific contribution of knowledge that the research makes (or is supposed to make). This is where the claims are actually articulated. The claims need to clearly stated and understandable. (Hirschheim 2008, p. 436)

C) Presentation and Structure

Hirschheim introduces:

> Presentation refers to the logical sequence of the arguments presentation. It also involves the rhetorical style used by the authors, or how the claims are articulated to the reader. They must be presented in an intelligible way. (Hirschheim 2008, p. 437)

D) Theoretical Foundation

The author outlines:

> Theoretical foundation refers to the theories, frameworks, or underlying concepts that are used to guide the research. Different disciplines have diverse bases for accepting or not accepting various theoretical arguments. Theoretical foundations relate to warrants – the assumptions and beliefs that lie behind the claims. They provide the raison d´etre for the claims. (Hirschheim 2008, p. 438)

E) Data Analysis/Interpretation/Argumentation

Hirschheim emphasizes that:

> In speaking about data here, it does not necessarily have to be empirical data. Data can come from many sources, and the reviewer has to be open to consider whatever type of data the authors may use. Moreover, data analysis/interpretation is broader than the application of some statistical technique; it refers to how whatever data used in the research is analyzed and/or interpreted in a rigorous fashion. In the Toulmin sense, his refers to the grounds or support for the claims. (Hirschheim 2008, p. 438)

F) Results

The author describes:

> Results refer to the output of the research inquiry. Having undertaken the research, this constitutes what was actually produced by the authors. In the sense of Toulmin, this is where the claims, grounds and warrants all come together in one coherent unit. Metaphorically, this is 'where the rubber meets the road'. (Hirschheim 2008, p. 439)

G.) Conclusions

Hirschheim sees:

> Conclusions should be the extrapolation of what was learned from the research. Many authors use the Conclusions section of their papers as summaries, simply repeating what they did. However, Conclusions should be the section where the authors take the opportunity to discuss what the results conceptually mean and what the implications are for research and practice. There are several ways to address this: (Hirschheim 2008, p. 439)

Final Thoughts

Hirschheim concludes:

> While the review process is valuable for the institutional dissemination of all scholarly work, one is tempted to say it is especially valuable for knowledge claims not using empirical data, as these types of papers are largely based on conceptual thinking and argument. Traditional articles based on quantitative or qualitative data can typically be evaluated using a somewhat standard review template and by looking at weak points in sampling, statistical analysis, operationalization, or research design. The same cannot be said of a conceptual paper — it only stands on the strength of its argument and the originality of its thinking. And it is here where reviews can really add value. (Hirschheim 2008, p. 440)

Finally, the author summarizes that:

> reviewers can play a key role in helping to mold the authors' ideas into a coherent and effective message. Submitted papers improve through the review process. And, while it doesn't always work to the authors' liking (e.g., rejected papers, endless rounds of revisions), and it does have its drawbacks (length of the review process, can't disseminate ideas quickly, difficulty in getting novel ideas accepted, etc.), it is generally regarded as the best mechanism available. The review process represents the community's best efforts at assuring that knowledge creation and dissemination are done effectively. A good review process ensures that the best ideas get exposed and published and, it is hoped that good ones do not get mistakenly weeded out. Indeed, it is probably true to say that a good publication is constructed among authors, reviewers, and editors. Each must take his or her responsibility seriously. Each must also realize that the system only works when everyone contributes effectively. If you submit papers to any top level journal, you must be willing to perform review duties as well, and perform them in a timely and effective fashion. Not only is this necessary as your fair share and contribution to the community process, it also helps individuals learn how to build strong conceptual and theory papers. And even if you have not submitted papers to the journal, we might ask you to review papers for us if you possess the expertise needed to evaluate a particular submission. The journal not only needs good paper submissions, but good reviewers who complete good reviews. (Hirschheim 2008, p. 440)

Review of Hirschheim (2008)

The guidelines for reviewers Hirschheim gives are helpful and detailed. His style using the form of questions helps reviewers of conceptual papers pay attention to many important aspects. He shows how all the key concepts must be first defined and then used consistently. The thought experiment to apply his recommendations (A–G) to his own paper seems to give a good result. We considered this kind of conceptual research in Chapter 2 of our textbook (Järvinen 2012).

Although we much appreciate this article, we have some comments about the content:

1. Under title "Content" Hirschheim writes that

> given that a paper is like a set of building blocks where the blocks (i.e., arguments) have to be coherent and build upon one another, one has to ask: Is the basic strand of argument used throughout the paper logically consistent and believable? (Hirschheim 2008, p. 437)

   In addition to the emphasis of logical reasoning, all the building blocks should have the same basic assumptions, i.e., a human being can be assumed to be a machine, an organism or a self-steering system (Järvinen 2012, Section 4.4 and Chapter 6). For example, we cannot combine the building block that assumes a human being is a machine with another building block that assumes a human being is a self-steering system.
2. Hirschheim uses Toulmin's (1958) framework. He does not especially consider design science where the importance of practitioners' utilitygoals must be considered, too. In traditional studies, it is enough that a result found by researchers is true.
3. A theory, model or framework can be built 1) by deriving from the theoretical assumptions concerning a user and a computer (i.e., in the deductive way, e.g., Wand. and Wang 1996), or 2) by generalizing from the observations made by researcher and from the results of previous empirical studies (i.e., in the inductive way, e.g., DeLone and McLean 1992). Hirschheim does not use this differentiation.

2.7 Grounded theory studies

Urquhart, Lehmann and Myers provide guidelines for grounded theory (GT) studies. After developing a substantive theory, they demand abstraction and externalization.

Urquart et al. (2010)

Introduction

The authors state:

> Over the past decade, there has been increasing interest in the use of grounded theory in information systems research (Howcroft & Hughes, 1999; Hughes & Howcroft, 2000; Urquhart, 2001; 2007; Lundell & Lings, 2003; Bryant et al., 2004; Lings & Lundell, 2005). ... The major difference between grounded theory and other qualitative research methods is its specific approach to theory development – grounded theory suggests that there should be a continuous interplay between data collection and analysis. (Urquart et al. 2010, p. 357)

Grounded Theory method - an overview

Urquart et al. describe that

> Barney Glaser and Anselm Strauss published a book entitled "The Discovery of Grounded Theory" in 1967 (Glaser & Strauss, 1967). This book outlined a research methodology that aimed at systematically deriving theories of human behavior from empirical data. It was a reaction against 'armchair' functionalist theories in sociology (Dey, 1999; Kendall, 1999). (Urquart et al. 2010, p. 359)

Later, however, there is a clear disagreement between the two founders, Glaser and Strauss:

> Glaser disagreed on two fundamental issues. First, Strauss & Corbin (1990) suggested breaking down the coding process into four prescriptive steps (open, axial, selective and 'coding for process'), whereas Glaser uses just three: open, selective and theoretical coding, at incremental levels of abstraction. Second, Glaser objected to the use of a coding paradigm and the 'conditional matrix', which are designed to provide ready-made tools for the conceptualization process. Glaser pointed out that to 'force' coding through one paradigm and/or down one conditional path was not grounded theory, but conceptual description, which ignored the emergent nature of grounded theory (Glaser, 1992). Also, the coding paradigm used by Strauss and Corbin – which suggests that the researcher looks at context, conditions, action/ interactional strategies, intervening conditions and consequences for the purposes of establishing categories and relationships – can be further critiqued as a departure from traditional grounded theory. (Urquart et al. 2010, p. 361-362)

It is important that a researcher knows and informs readers that she will follow either Glaser's or Strauss' line. Urquhart et al. developed a figure for GT and state:

> The process of generating a grounded theory is summarized in Figure 1 [Figure 9]. A researcher begins a grounded theory study with ideational constructs, such as 'hunches' (Miles & Huberman, 1984), for investigation. It is important to note that despite the injunction to try to avoid having any preconceived theoretical ideas before starting the research, these seed concepts or early hunches 'can come from sources other than data' (Glaser & Strauss, 1967, p. 6). These seed concepts help a researcher to select an area of enquiry and define the topic. The area of enquiry is called the 'substantive area' in grounded theory terminology. (Urquart et al. 2010, p. 362)

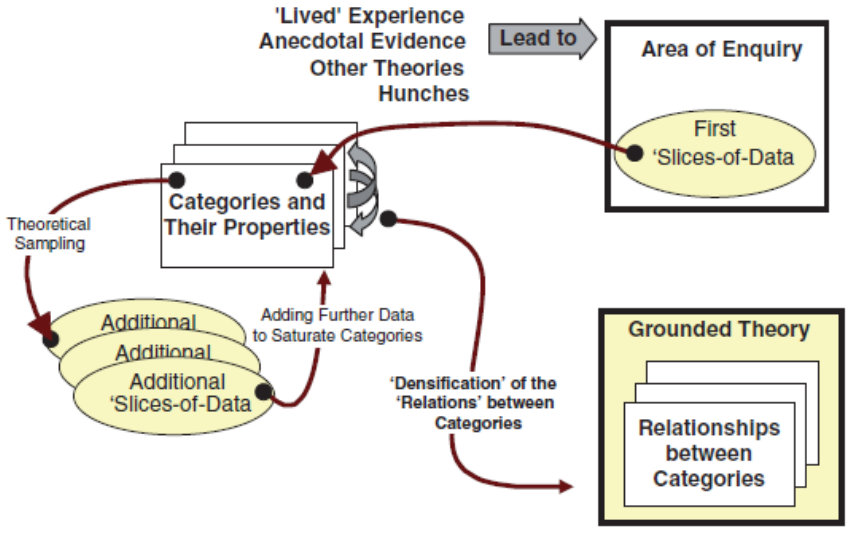

Figure 9 Cycle of data collection and analysis in the grounded theory method [after Lehmann (2001) and Fernandez *et al.* (2002)]. (Urquhart et al. 2010, p. 363)

In this article, the authors emphasize a more formal theory than the normal substantive one:

> Figure 2 [Figure 10] depicts this hierarchy of theories. The general idea of using grounded theory is that as the researcher moves up the level of abstraction, the range and scope of the theory increases. (Urquart et al. 2010, p. 364)

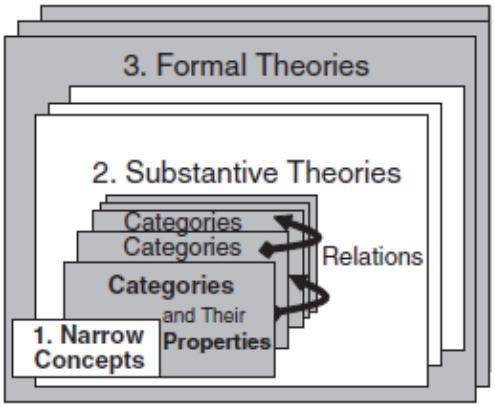

Figure 10 The progression of theory development in the grounded theory methodology (adapted from Lehmann, 2001) (Urquhart et al. 2010, p. 364)

A framework for theorizing in Grounded Theory studies

The authors describe their framework as follows:

> We have observed in our own grounded theory work and in that of others that two aspects are important for theorizing. These two aspects are the degree of conceptual-ization and theory scope. These two dimensions underline the grounded theory process of theory building – conceptualization that moves beyond mere description, and also considers relationships between categories, and pitching the theory scope at the appropriate level. The first axis – the degree of conceptualization, can be seen as relating to the process of building a grounded theory, and relates to the degree of analysis carried out. The second axis, theory scope, can be seen to relate to the outcome of building a grounded theory. A summary of the framework is shown in Figure 3 [Figure 11]. (Urquart et al. 2010, p. 365)

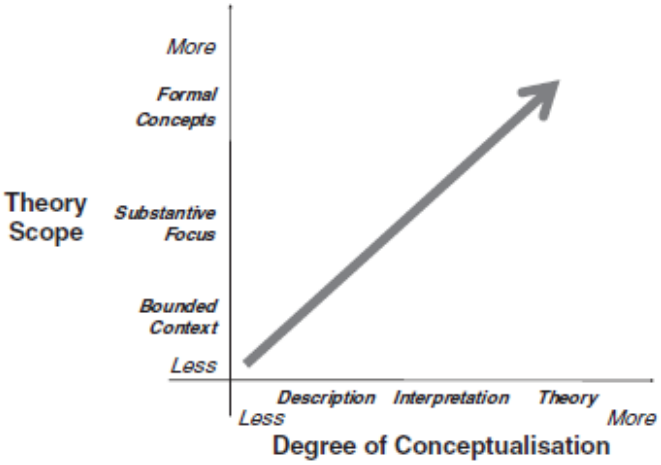

Figure 11 A framework for analyzing grounded theory studies (Urquhart et al. 2010, p. 366)

Urquart et al. (2010) describe their dimensions: conceptualization (description, interpretation, theoretical coding) and theory scope (bounded context, substantive focus, formal concepts).

Guidelines for Grounded Theory studies in information systems

The authors ask:

> A key question that this paper seeks to address is: 'How can the grounded theory method be leveraged to build theory in information systems?' This section attempts to answer this question by proposing guidelines for the conduct and evaluation of grounded theory studies in information systems. These guidelines are oriented towards building theory in our field, and are summarized in Table 1 [Table 16]. The guidelines build on the two axes of the framework identified in the fourth section, concept ulization and theory scope. The first three guidelines address how the researcher might achieve the degree of conceptualization necessary to build a good theory through analytic mechanisms, such as constant comparison. These guidelines can also be seen as relating to the process of theory building. The final two guidelines give assistance with the issue of theory scope by giving guidance on the level of theory and how it might be integrated with the extant literature, an important aspect of theory building. Thus, these last two guidelines deal with the theory that is the outcome of the first three stages. (Urquart et al. 2010, p. 368)

Table 16 Guidelines for grounded theory studies in information systems (Urquhart et al. 2010, p. 369)

1 Constant comparison	Constant comparison is the process of constantly comparing instances of data labelled as a particular category with other instances of data in the same category. Constant comparison contributes to the development of theory by exposing the analytic properties of the codes and categories to rigorous scrutiny. This guideline for data analysis encourages researchers to be both rigorous and theoretical (Charmaz, 2006).

2 Iterative conceptualization	This guideline suggests that researchers should increase the level of abstraction and relate categories to each other through a process of iterative conceptualization. In grounded theory, this is done using theoretical coding. The relationships between categories can be of many different types, not just causal. Theoretical coding contributes to an understanding of relationships between the concepts or factors of a theory. Theoretical memos are also very important to the development of theoretical coding and the whole process of iterative conceptualization.
3 Theoretical Sampling	This guideline stresses the importance of deciding on analytic grounds where to sample from next in the study. Theoretical sampling helps to ensure the comprehensive nature of the theory, and ensures that the developing theory is truly grounded in the data.
4 Scaling up	This guideline suggests how a researcher might counter what is said to be a common problem in grounded theory viz. the production of a low level theory, which is then hard to relate to the broader literature. Scaling up is the process of grouping higher-level categories into broader themes. Scaling up contributes to the generalizability of the theory.
5 Theoretical integration	This guideline helps the researcher deal with what we think is an obligation of the grounded theorist – theoretical integration. Theoretical integration means relating the theory to other theories in the same or similar field. It is the process of comparing the substantive theory generated with other, previously developed, theories. This principle contributes to theoretical integration in the discipline and could help in the generation of formal theories.

Urquart et al. (2010) then describe guidelines (constant comparison, iterative conceptualization, theoretical sampling, scaling up and theoretical integration) in more detail.

Applying the guidelines

The authors illustrate:

> the usefulness of the guidelines by applying them to three grounded theory studies in information systems. The three studies are as follows:
> 1. Orlikowski's (1993) study of the use of CASE tools in two organizations;
> 2. Urquhart's (2001) study of the dialogue between a systems analyst and client in one of six case studies; and
> 3. Lehmann & Gallupe's (2005) analysis of the use of information systems in three multinational companies across multiple locations. (Urquart et al. 2010, p. 373)

Discussion and conclusions

In this section, Urquart et al. (2010) repeat their main results.

Review of Urquart et al. (2010)

Urquart et al. (2010) give reasons for the degree of conceptualization (description, interpretation and theory) and for the first three guidelines (1 Constant comparison, 2 Iterative conceptualization, 3 Theoretical sampling). The last two guidelines (4 Scaling up and 5 Theoretical integration) are said to be based on theory scope (bounded contexts, substantive focus and formal concepts). These

five guidelines may well help a junior scientist in GT and give more emphasis to theory.

Although we much appreciate this article, we have some comments:

1. Guidelines (1 Constant comparison, 2 Iterative conceptualization, 3 Theoretical sampling, 4 Scaling up and 5 Theoretical integration) are sequentially presented from a description to an abstract theory of a domain. Two dimensions (conceptualization and theory scope) are loosely connected to a sequence of guidelines. Especially, Guidelines 1, 2 and 3 and tasks are always performed when new data are gathered; i.e., they are not totally sequential.

2. The concept "category" is much used in the article but it is not defined, although it is one of the central concepts of GT. The authors state:

   > There is considerable disagreement and debate with regard to the underlying philosophical assumptions of grounded theory. Grounded theory belongs to the realm of qualitative empiricism and has been variously described as positivist, interpretive or critical. (Urquart et al. 2010, p. 360)

   The authors seem to speak about philosophical assumptions (Chua 1986). But later (p. 361), the authors state that "grounded theory is independent of the underlying epistemology" and "critical studies (Annells, 1996; Urquhart, 2001; Cecez-Kecmanovic *et al.*, 2008)" are performed.
   Guidelines for critical studies (Myers and Klein) were published in 2011. Heinz Klein passed away in June 2008. If the Myers and Klein (2011) article was submitted in 2008 or earlier, then some of critical theories (Habermas, Bourdiou and Foucault) should have been mentioned, and two conflicting parties were discussed.
   We cannot see a reference to any of the three theories or to any conflict. In this and the following section (2.8), two articles are co-written by the same researcher. We suspect that this researcher did not recognize two meanings of term 'critical': philosophical and general criticism.
   Richardson and Robinson (2007) examine critical IS-studies but could not find a GT study. In addition, the Myers and Klein (2011) article does not contain any GT study in IS.

3. In interpretive philosophy, there is a local language (Deetz 1996). Wiesche et al. write concerning GT that:

   > Rich descriptions are narratives based on empirical observations without abstraction (Van Maanen 1990). (Wiesche et al. 2017, p. 686)

   Wiesche et al. (2017) found models and rich descriptions from GT studies, not only (tentative) theories. - Thus, for example, when a researcher follows Guidelines 1, 2 and 3 she can receive a rich description. To abstract a rich description, a researcher must follow Guidelines 4 and 5, but the locality of the language may then be lost. Klein and Myers see that:

> it is important that theoretical abstractions and generalizations should be carefully related to the field study details as they were experienced and/or collected by the researcher. This is so readers can follow how the researcher arrived at his or her theoretical insights. (Klein and Myers 1999, p. 75)

5. Urquart et al. write that:

> in the field of information systems, meta-theories such as structuration theory (Orlikowski & Robey, 1991; Walsham, 2002) or actor–network theory (Walsham, 1997) may be a useful lens through which to view the emergent theory. (Urquart et al. 2010, p. 373)

We pay attention to structuration theory (Giddens 1984) where a two-directional (↔) relationship exists when researchers in IS often have a one-directional (either → or ←) relationship only.

6 Urquart et al. (2010) have two dimensions: conceptualization (description, interpretation, theoretical coding) and theory scope (bounded context, substantive focus, formal concepts). We doubt that two dimensions are not orthogonal, because both emphasize theoretical aspects.

2.8 Critical research

Myers and Klein use critical theories from Habermas, Bourdieu and Foucault, and propose six principles for how to conduct critical research. These principles are derived from those three theories. (The article mentions that the second author, Heinz Klein, died in 2008. We are thankful that the first author, Mike Myers, then completed this article.)

Myers and Klein (2011)

Introduction

Myers and Klein describe that:

> Critical research is emerging as a potentially important stream in information systems research. Critical research in information systems is concerned with social isues such as freedom, power, social control, and values with respect to the development, use, and impact of information technology. (Myers and Klein 2011, p. 17)

The authors then complain that critical research has not yet been recognized as a legitimate approach in IS. The authors consider that their purpose is

> to propose a set of principles for the conduct of critical field research in information systems. In order to achieve this purpose, we examine the nature of the critical research perspective, clarify its significance, and review the major discourses in critical social research. The principal motivation is to clarify the most basic mission of critical research, recognizing that this mission cannot be captured by a fixed set of criteria once and for all. However, it should be possible to formulate a set of principles capturing some of the commonalities of those approaches that have so far become visible in the IS research literature. (Myers and Klein 2011, p. 18)

The authors also emphasize that it is better to have some principles than none at all.

Critical Research

Myers and Klein use:

> Orlikowski and Baroudi's (1991) classification scheme, which itself is based on Chua's (1986) work. They suggest three research paradigms: positivist, interpretive, and critical. (Myers and Klein 2011, p. 19)

Chua's (1986) original description of the critical perspective seems appropriate (see Table 17).

Table 17 Dominant assumptions of the critical perspective (Chua 1986, p. 622)

A. Beliefs about knowledge
Criteria for judging theories are temporal and context-bound. (Epistemological)
Historical, ethnographic research and case studies more commonly used. (Methodological)
B. Beliefs about physical and social reality
Human beings have inner potentialities which are alienated (prevented from full emergence) through restrictive mechanisms. Objects can only be understood through a study of their historical development and change within the totality of relations. (Ontological)
Empirical reality is characterized by objective, real relations which are transformed and reproduced through subjective interpretation.
Human intention, rationality, and agency are accepted, but this is critically analyzed given a belief in false consciousness and ideology. (Human intention and rationality)
Fundamental conflict is endemic to society. Conflict arises because of injustice and ideology in the social, economic, and political domains which obscure the creative dimension in people. (Societal order / conflict)
C. Relationship between theory and practice
Theory has a critical imperative: the identification and removal of domination and ideological practices.

Myers and Klein collect eight typical critical IS studies and find three researchers (Habermas [Lyytinen and Klein 1985, Ngwenama 1990, Hirschheim and Klein 1994, Ngwenama and Lee 1997, Kanungo 2004], Bourdieu [Levina 2005, Kvasny and Keil 2006] and Foucault [Doolin 2004]) behind them. This means that in those eight studies there are critical theories developed by Habermas, Bourdieu or Foucault. The authors inform the reader that

> Table 2 [Table 18] presents an overview of the three critical research streams. Of course, it is impossible to do justice to all the writings of the three thinkers here. Hence, we highlight some of their most fundamental ideas only. (Myers and Klein 2011, p. 21)

Table 18 Characteristics of the three major critical research streams (Myers and Klein 2011, p. 22)

	Bourdieu	Foucault	Habermas
Lineage (sources of influence)	Marx, Durkheim, Weber, Saussure, Wittgenstein, Canguilhem (Harker et al. 1990). Early work also strongly influenced by French structuralism (e.g., Levi-Strauss) and later by Heidegger.	Nietzsche, Heidegger (Brocklesby and Cummings 1996), and Canguilhem (Macey 2000).	Kant then Hegel and Marx (Brocklesby and Cummings 1996), followed by Nietzsche.
Main research focus	Forms of behavior—that appear to be spontaneous and natural—that are in fact socially conditioned; the power of symbolic systems and their domination over the construction of reality; hidden mechanisms of reproduction of social and cultural practices (Macey 2000).	Discursive practices from the perspective of history of epistemology and theory of knowledge; he described himself as a "specialist in the history of systems of thought" (Macey 2000, p. 133).	*Until about 1973:* Philosophical examination of the relationship between knowledge and human interests; a reconsideration of the validity of natural science methods for the social and cultural sciences. *After 1973:* Communicative action as the basis of modern societies.
Espoused values	Explicit values are consistent with but not explicitly derived from the enlightenment ideal (e.g., participatory democracy, non-exploitative working conditions, and open education).	Explicitly skeptical of the viability of the enlightenment ideal as revealed in the debate with Habermas, but believed that local and individual emancipation may be possible.	Explicit commitment to complete the unfinished project of enlightenment with endorsement of its linearity based on Kant.
Important concepts	Habitus, field, social, cultural and symbolic capital (Harker et al. 1990).	Discourse; archaeology and genealogy of knowledge, and panopticon.	Cognitive interests, communicative action and strategic action; lifeworld and systems.
Research approach	Ethnographic field studies of exploitative work practices in Algeria and underrepresentation of working class children in tertiary education in France.	Detailed historical studies of institutions such as the birth of the clinic and the functioning of the penal system revealing the interdependence of knowledge and power in discursive social practices	Applying concepts from the history of social philosophy to rational reconstruction of self-formative processes resulting in cognitive interest theory. Later the complete reformulation of critical social theory in the theory of communicative action.

The authors verbally explain every column (called lineage) of Table 18. Then, they analyze elements of critical research as follows:

> Although there are different ideas about how to proceed with critical field research in the literature, Alvesson and Deetz (2000) suggest that critical research is comprised of three elements. They name these three elements insight, critique, and transformative redefinition. The use of the term elements serves to emphasize that, in the practice of critical research, it might neither be practical nor desirable to completely separate these three elements from each other; they are all, to some extent, interconnected. All three elements are present in a critical study. The three elements are summarized in Table 3 [Table 19]. (Myers and Klein 2011, p. 23)

Table 19 The three elements of critical research (Myers and Klein 2011, p. 23)

	Brief Description
Insight	This element is concerned with interpretation and gaining insight. Insight can be gained in various ways, e.g., using critical hermeneutics and the archaeology of knowledge, or the concepts of social reproduction via the mechanisms associated with symbolic capital.
Critique	This element is concerned with critique, the genealogy of knowledge, and the social practices of control and reproduction. This element goes beyond interpretation to focus the researcher on the power structures that lie behind accepted interpretations.
Transformation	This element is concerned with suggesting improvements to the conditions of human existence, existing social arrangements, and social theories. Theories are not the primary driver for changes, but potentially fallible lenses through which we see the world. The ultimate arbiters of the desirability of changes are those affected by them.

The authors explain insight, critique and transformation in detail and conclude that it is important to concentrate on the two latter more carefully, because they represent real critical research.

A Set of Principles for Critical Research

Myers and Klein propose:

> a set of principles for the conduct of critical field research in information systems. There are two sources for these principles: the past practice of critical field research in information systems and other management disciplines and our understanding of the underlying philosophical foundations of critical research. The principles are summarized in Table 4 [Table 20]. (Myers and Klein 2011, p. 24)

Table 20 A proposed set of principles for critical research (Myers and Klein 2011, p. 25)

The Element of Critique
1. The principle of using core concepts from critical social theorists This principle suggests that critical researchers should organize their data collection and analysis around core concepts and ideas from one or more critical theorists.
2. The principle of taking a value position Critical theorists advocate values such as open democracy, equal opportunity, or discursive ethics. These values drive or provide the basis for Principles 4 through 6.

3. The principle of revealing and challenging prevailing beliefs and social practices This principle suggests that critical researchers should identify important beliefs and social practices and challenge them with potentially conflicting arguments and evidence.
The Element of Transformation
4. The principle of individual emancipation All critical social theory is oriented toward facilitating the realization of human needs and potential, critical self reflection, and associated self-transformation.
5. The principle of improvements in society This principle suggests that improvements in society are possible. The goal is not just to reveal the current forms of domination, but to *suggest* how unwarranted uses of power might be overcome (although the critical theorist should not assume any special position of authority). Most critical theorists assume that social improvements are possible, although to very differing degrees.
6. The principle of improvements in social theories All critical theorists believe that our theories are fallible and that improvements in social theories are possible. Critical researchers entertain the possibility of competing truth claims arising from alternative theoretical categories, which can guide critical researchers in their analyses and interventions.

In Table 20, there are only two elements (critique and transformation), because the first element of insight is virtually identical to the type of insight that is provided by interpretive research.

The Principle of Using Core Concepts from Critical Social Theorists

Myers and Klein state their first principle, marking:

> a point of departure from pure interpretivism. Generally speaking, critical researchers start out with a priori theoretical concepts derived from one or more critical theorists, although the selection of theory depends upon which concepts are judged to be of most relevance to the social situation being studied. We note that many researchers, both from IS and other disciplines, simply use critical theory as a synonym for critical research (Cecez-Kecmanovic 2001; Kincheloe and McLaren 2005; Prasad and Caproni 1997). (Myers and Klein 2011, p. 26)

They recommend a critical researcher organize her data and its analysis according to a certain critical theorist.

The Principle of Taking a Value Position

The authors write:

> The second principle explicitly recognizes the importance of taking a value position for motivating and grounding a critical research project. Critical theorists advocate values such as open democracy, equal opportunity, or discursive ethics. This value position, along with the theoretical concepts of the first principle, provides the foundation for the principles that follow. Of course, this principle is not meant to imply that positivist or interpretive researchers do not have their own values. (Myers and Klein 2011, p. 26)

Myers and Klein note that their three philosophers, Habermas, Bourdieu and Foucault, have connections with Western culture.

The Principle of Revealing and Challenging Prevailing Beliefs and Social Practices

Myers and Klein state:

> Rather than simply describing current beliefs and social practices, this principle builds on the first two to challenge prevailing assumptions, beliefs, values, and practices that are often taken for granted. This can be done by constructing counter arguments and exposing the biased or insufficient nature of the evidence.
>
> This principle is particularly important for IS researchers because the concepts of information, knowledge, and their uses are central to the information systems field. The principle analyzes the relations or forces determining what counts as knowledge and information and what are their legitimate uses. (Myers and Klein 2011, pp. 26-27)

The Principle of Individual Emancipation

In this subsection and the following one, Myers and Klein differentiate the consideration of transformation at the individual and society levels. Concerning the individual level, they state:

> The fundamental idea of human emancipation in critical theory arises from Kant's definition that human enlightenment involves thinking autonomously, free of the dictates of external authority.
>
> The principle of emancipation requires that the researcher assume a value stance that potentially takes issue with some of the human conditions or practices in the domain being investigated. These practices may be in some sense unjust or harmful or at least unfair for some subgroup. The critical researcher thus has the important analytical task of identifying possibilities for change both in their physical and social circumstances. He or she seeks to enlighten people as to their real situation (Brocklesby and Cummings 1996, p. 742). (Myers and Klein 2011, p. 27)

The Principle of Improvement in Society

When thinking about transformation in society, Myers and Klein write:

> Building on the previous principle, this principle suggests that improvements may be possible, not just at an individual level, but in society as a whole. In fact it can be argued that one of the purposes of social theory is to suggest improvements to organizations, institutions (e.g., the press and public education), and society. Critical theorists have argued that improvements at all levels must go hand in hand, because their success is contingent on each other. This principle thus sug-gests that the critique of social conditions or practices should not only lead to better understanding (enlightenment), but that it should also lead to improvements in social practices and society as a whole. However, the direction of the improvement must emerge from internal, self-formative governing processes, in which critical theorists must not be given any special powers of authority. (Myers and Klein 2011, p. 27-28)

The Principle of Improvements in Social Theories

The authors demand following:

> This principle is concerned with the growth and improvement of theoretical knowledge. Although principle one suggests that critical researchers should organize their data collection and analysis around the core concepts and ideas from one or more critical social theorists, this does not mean that these concepts should remain unchallenged or that new ones might not emerge." and they continue "This last principle suggests that critical researchers should be willing to subject their own research project to self-critique. It also

> suggests that, in IS especially, some critical researchers should be seeking to improve socio-technical theory. (Myers and Klein 2011, p. 28)

Examples of Critical Research

Myers and Klein take three examples of critical studies from three social theorists they use: Doolin (2004) / Foucault, Kanungo (2004) / Habermas, and Kvasny and Keil (2006) / Bourdieu.

Discussion and Conclusions

The authors first consider the similarities and differences between interpretive and critical research. They then consider the added value of critical research and finally, the contribution of this article for strengthening critical research.

Review of Myers and Klein (2011)

Although Chen and Hirschheim claimed that "no empirical research work was done using a critical paradigm (0%)", Richardson and Robinson (2007) found 31 studies that used a critical approach. Such studies clearly require some principles for evaluating how well a certain study is conducted whether the results are believable. Myers and Klein present six principles, three for critique and three for transformation. This seems to be reasonable. Dialectics is often seen behind critical research philosophy. Thus, Principle 1 concerning concepts is important, because the critical research philosophy differs considerably from other philosophies. Principle 2 emphasizing values is important, because values play a central role in critical philosophy. A similar reason is suitable for Principle 3. Principles 4 and 5 concern transformation at the individual and society levels.

Critical research seems refer to a critical perspective (Chua 1986). Cecez-Kecmanovic et al. (2020) view as follows:

> While critical researchers often apply interpretivist methods (such as ethnography) they do so in a distinctly critical way: by clearly and explicitly articulating values and ethical positions that motivate and drive their research projects (principle 2). (Cecez-Kecmanovic et al. 2020, p. 251)

Their view is not quite correct.

Although we appreciate this article, we have some comments.

1. The authors take three researchers (Habermas, Bourdieu and Foucault) on whose studies the six principles are based. We took Chua's (1986, p. 622) dominant assumptions of critical perspective above and added "epistemology, methodology" etc. in brackets. It or a pure dialectics could give another starting point for guidelines than presented.
2. After publication of the Myers and Klein (2011) article, we asked whether Myers could accept an activity theory (Engeström 1987) as a supplement to those three theories (Habermas, Bourdieu and Foucault). But he was not

eager to accept although Virkkunen and Kuutti (2000) used activity theory in understanding organizational learning.

2.9 Mixed methods

Venkatesh, Brown and Bala (2013) find that although guidelines for conducting and evaluating all the different types of research (e.g., positivist case study, ... , critical research) have been widely considered in IS literature, guidelines for mixed methods research are lacking. The authors motivated as follows:

> Diversity in research methods is considered a major strength of information systems (IS) research. IS researchers have employed a plethora of different research methods that can, at one level, be broadly categorized into two: quantitative and qualitative. One of the recurring issues in social and behavioral sciences research is the relative value of different research approaches, especially with intense debates on different epistemologies (e.g., positivist versus interpretive) and methodologies (e.g., qualitative versus quantitative). (Venkatesh et al. 2013, p. 21)

We supplement Venkatesh et al. (2013) by citing the abstract written by Venkatesh, Brown and Sullivan (2016):

> In this paper, we extend the guidelines of Venkatesh et al. (2013) for mixed-methods research by identifying and integrating variations in mixed-methods research. By considering 14 properties of mixed-methods research (e.g., purposes, research questions, epistemological assumptions), our guidelines demonstrate how researchers can flexibly identify the existing variations in mixed-methods research and proceed accordingly with a study design that suits their needs. To make the guidelines actionable for various situations and issues that researchers could encounter, we develop a decision tree to map the flow and relationship among the design strategies. We also illustrate one possible type of mixed-methods research in information systems in depth and discuss how to develop and validate meta-inferences as the outcomes of such a study. (Venkatesh et al. 2016, p. 435)

Venkatesh et al. (2013)

In this section, we present guidelines for mixed methods research in a nutshell, because we already have positivist studies (Straub et al. 1994) and interpretive field studies (Klein and Myers 1999) in Sections 2.2 and 2.3, respectively. Both types of methodology can use quantitative and qualitative methods, but Venkatesh et al. seem to concentrate on mixed methods. We mostly cite the Discussion section, because the main results are presented completely there.

Venkatesh et al.'s (2013) primary goal

> is to facilitate discourse on mixed methods research in IS, with a particular focus on encouraging and assisting IS researchers to conduct high quality, rigorous mixed methods research to advance the IS discipline. We are sensitive to the issue that a paper such as this can be misinterpreted in at least two ways. First, it could be viewed that mixed methods research is now an imperative for publication in journals, such as MIS Quarterly. Second, these guidelines could be seen as legislative. In this section, in addition to reiterating that neither of these viewpoints represents our intention or perspective, we discuss contributions and implications of this work. Although a mixed methods approach

> clearly has certain advantages over a mono-method approach, it is not a silver bullet to problems that are associated with any single method. ...
>
> Overall, although our guidelines have the potential to offer a way to integrate the strengths of two data collection methods, it may not always be feasible or desirable to do so. We urge IS researchers to carefully think about their research objectives, theoretical foundations, and context before conducting mixed methods research. This paper serves as a call for further work to examine the integration of quantitative and qualitative data collection methods within a single study. (Venkatesh et al. 2013, p. 48)

Venkatesh et al. (2013, p. 41) offer the following broad guidelines for validation in mixed methods research in IS. Table 21 provides a summary of these guidelines. The table consists of two parts:

General guidelines:

1. Decide on the appropriateness of a mixed methods approach.
2. Develop a strategy for mixed methods research design.
3. Develop a strategy for analyzing mixed methods data.
4. Draw meta-inferences from mixed methods results.

Validation guidelines:

1. Discuss validation within quantitative and qualitative research.
2. Use mixed methods research nomenclature when discussing validation.
3. Discuss validation of mixed methods findings and/or meta-inference(s).
4. Discuss validation from a research design point of view.
5. Discuss potential threats and remedies.

Guidelines are given separately for researchers and editors/reviewers.

Table 21 Summary of mixed methods guidelines (Venkatesh et al. 2013, p. 41)

Guideline	Author Considerations	Editor/Reviewer Evaluation
Area: General Guidelines		
(1) Decide on the appropriateness of a mixed methods approach.	Carefully think about the research questions, objectives, and contexts to decide on the appropriateness of a mixed methods approach for the research. Explication of the broad and specific research objective is important to establish the appropriateness and utility of mixed methods research.	Understand the core objective of a research inquiry to assess whether mixed methods research is appropriate for an inquiry. For example, if the theoretical /causal mechanisms /processes are not clear in a quantitative paper, after carefully considering the practicality, ask authors to collect qualitative data (e.g., interview, focus groups) to unearth these mechanisms and processes.
(2) Develop a strategy for mixed methods research design.	Carefully select a mixed methods design strategy that is appropriate for the research questions, objectives, and contexts ~~(see Table 6 for the definition of design suitability and adequacy)~~.	Evaluate the appropriateness of a mixed methods research design from two perspectives: research objective and theoretical contributions. For example, if the objective of a research inquiry is to identify

		and test theoretical constructs and mechanisms in a new context, a qualitative study followed by a quantitative study is appropriate (i.e., sequential design).
(3) Develop a strategy for analyzing mixed methods data.	Develop a strategy for rigorously analyzing mixed methods data. A cursory analysis of qualitative data followed by a rigorous analysis of quantitative data or vice versa is not desirable.	While recognizing the practical challenges of collecting, analyzing, and reporting both qualitative and quantitative data in a single research inquiry, apply the same standards for rigor as would typically be applied in evaluating the analysis quality of other quantitative and qualitative studies.
(4) Draw metainferences from mixed methods results.	Integrate inferences from the qualitative and quantitative studies in order to draw meta-inferences.	Ensure that authors draw meta-inferences from mixed methods research. Evaluation of meta-inferences should be done from the perspective of the research objective and theoretical contributions to make sure the authors draw and report appropriate meta-inferences.
Area: Validation		
(1) Discuss validation within quantitative and qualitative research.	Discuss validation for both quantitative and qualitative studies.	Ensure that authors follow and report validity types that are typically expected in a quantitative study. For the qualitative study, ensure that the authors provide either explicit or implicit (e.g., rich and detailed description of the data collection and analyses) discussion of validation.
(2) Use mixed methods research nomenclature when discussing validation.	When discussing mixed methods validation, use mixed methods research nomenclature.	Ensure that the authors use consistent nomenclature for reporting mixed methods research validation.
(3) Discuss validation of mixed methods findings and/or meta-inference(s).	Mixed methods research validation should be assessed on the overall findings from mixed methods research, not from the individual studies.	Assess the quality of integration of qualitative and quantitative results. The quality should be assessed in light of the theoretical contributions.
(4) Discuss validation from a research design point of view.	Discuss validation from the standpoint of the overall mixed methods design chosen for a study or research inquiry.	Assess the quality of meta-inferences from the standpoint of the overall mixed methods design chosen by IS researchers (e.g., concurrent or sequential).
(5) Discuss potential threats and remedies.	Discuss the potential threats to validity that may arise during data collection and analysis.	Evaluate the discussion of potential threats using the same standard that is typically used in rigorously conducted qualitative and quantitative studies.

In the subsection "Theoretical contributions," the authors state that their key contributions are three-fold:

> Our first contribution is the delineation of an overview of mixed methods research based on recent advances in this area. We reviewed six leading IS journals identified in the Senior Scholars' Basket of Journals (AIS 2007) to understand the state of mixed methods research in IS. Our review suggests that there is a dearth of mixed methods research in IS, and there are no standards or guidelines for conducting and evaluating such research in IS. We also provided a set of general guidelines for conducting mixed methods research in IS. We focused on three important areas in our guidelines: (1) appropriateness of a mixed methods approach; (2) development of meta-inferences (i.e., substantive theory) from mixed methods research; and (3) assessment of the quality of meta-inferences (i.e., validation of mixed methods research). We provided in-depth discussions of these three areas because there has been limited discussion and understanding of when to conduct mixed methods research (i.e., appropriateness), how to discover and develop integrative findings from mixed methods research (i.e., meta-inferences), and how to assess the quality of meta-inferences (i.e., validation). This paper should initiate scholarly discourse regarding these three areas to encourage IS researchers to engage in high quality mixed methods research. (Venkatesh et al. 2013, p. 48)

Concerning term "appropriateness," the authors define it (p. 23): "understanding of when to conduct mixed methods research". It is also a correct demand more generally: Understand when to conduct research concerning 'what is a certain part of reality?', i.e., in all Sections 2.1-2.3 and 2.6-2.8. Required appropriateness of a certain study is broad.

The authors then move (Latin *in medias res*) to the central requirement for mixed methods research, meta-inferences. Venkatesh et al. (2013) emphasize this topic. The authors claim that their second contribution is:

> related to developing meta-inferences. We suggest that meta-inferences are essential components of mixed methods research. If researchers fail to develop meta-inferences from mixed methods research, it is difficult to develop substantive theory or make theoretical contributions. If researchers do not intend to develop meta-inferences and instead plan to publish mixed methods research in multiple publications as single method articles, the very purpose of conducting mixed methods research will not be achieved. The shortage of true mixed methods research programs seems to indicate that IS researchers indeed publish single method articles from mixed methods research programs. Although researchers may do so to avoid paradigmatic, cultural, cognitive, and physical challenges associated with conducting mixed methods research and developing meta-inferences, we argued that such a practice will lead to contribution shrinkages and communal disutility in the IS literature. (Venkatesh et al. 2013, p. 48)

Their third contribution is:

> the development of an integrative framework for performing and assessing validation (quality of) for mixed methods research in IS. Although much progress has been made on mixed methods research design and data analysis in other social sciences disciplines, there has not been much discussion of validation (Teddlie and Tashakkori 2003). We developed these guidelines from the recent work on mixed methods research and discussed it in the context of IS research. We expect that these guidelines will be useful in conducting and evaluating mixed methods research in IS. Lee and Hubona (2009) recently provided a valuable discussion of the importance of validation in quantitative and qualitative IS research. This work augments their suggestions by offering and illustrating validation guidelines for mixed methods research in IS. (Venkatesh et al. 2013, p. 48)

We divide objects of research in reality to 1) studies for analysis of parts in a world as they are and 2) studies emphasizing the utility of the parts in a world in the present or in the future. The latter concern design and action research, and the former almost all other studies, i.e., similar to the first contribution (appropriateness).

Review of Venkatesh et al. (2013)

Venkatesh et al. (2013) deeply analyze where mixed methods research is most suitable. They stress (1) *appropriateness*, (2) *meta-inferences* and (3) *validation*. The first and third aspects are important for many methodologies (Sections 2.1-2.3, 2.6-2.8) but they are mentioned explicitly only in this section. Meta-inferences are intended only for mixed methods research, and the authors emphasize it with good reason.

In this good paper, there are some minor inaccuracies.

1. For example, Venkatesh et al. (2013) give a long list of papers in which there are guidelines, but in Lee (1989), we do not find any term "guideline". Mingers (2001) does not consider single but a pluralist methodology although he considers some important methodological problems. Some old guidelines (Benbasat et al. 1987, Straub et al. 1994) and newer ones (Davison et al. 2004, 2012, Urquart et al. 2010) are missing from the list given by Venkatesh et al. (2013).
2. The division between quantitative and qualitative seems to differentiate things at many levels and between object types: data, data collection approach, sampling, measure, validation, validity type, inference, study, research, analysis, component, finding, result, paper, research method, strand, methodology, (research) approach, paradigm, world view and science. The differentiation between quantitative and qualitative seems to be very strong. Some differentiations do not seem to be opposite, but they must be avoided, e.g., quantitative vs. qualitative sciences. A smaller number of different aspects might help the reader.
3. The authors seem to use the term "paradigm" in such a way that it causes uncertainty about what it really means. They write:

> Mixed methods research has been termed the third methodological movement (paradigm), with quantitative and qualitative methods representing the first and second movements (paradigms) respectively (Ridenour and Newman 2008; Teddlie and Tashakkori 2003, 2009). (Venkatesh et al. 2013, p. 22)

Our interpretation of this is paradigm of methodology. However, the authors also write (p. 37):

> If IS researchers prefer to embrace an alternative paradigm as the epistemological foundation of mixed methods research, there are at least three mixed methods research paradigms from which they can choose: (1) pragmatism, (2) transformative– emancipatory, and (3) critical realism. (Venkatesh et al. 2013, p. 37)

We think that paradigm then means research paradigm, and it may cover ontology, epistemology, human nature and methodology (cf. Chua 1986).

Venkatesh et al. (2016)

The authors describe their proposed changes as follows:

> Although Venkatesh et al.'s (2013) guidelines discuss several properties of mixed-methods research (i.e., paradigmatic assumptions, purposes of mixed-methods research, time orientation, and quality of meta-inferences), the guidelines do not discuss other properties that one can use to develop strategies for conducting mixed-methods research. Further, although some researchers have previously attempted to integrate different properties of mixed-methods research (e.g., Maxwell & Loomis, 2003; Nastasi et al., 2010), existing mixed methods do not elaborate on different design variations and the relationships among them. Thus, we extend Venkatesh et al.'s (2013) guidelines by integrating different properties of mixed-methods research into the guidelines. Identifying how different properties are related and determining how one design decision may lead to another decision will help researchers develop a high-quality mixed-methods study (Guest, 2012; Tashakkori & Teddlie, 2003b). (Venkatesh et al. 2016, p. 438)

Table 22 maps the 14 properties to Venkatesh et al.'s (2013) guidelines.

Table 22 Guidelines to properties mapping (Venkatesh et al. 2016, p. 440)

Guidelines (Venkatesh et al. 2013)	**Properties of mixed-methods research**
1) Decide on the appropriateness of a mixed-methods approach.	Foundations of design decisions: • Research questions • Purposes of mixed-methods research • Epistemological perspectives • Paradigmatic assumptions
2) Develop strategies for mixed-methods research designs.	Primary design strategies: • Design investigation strategies • Strands/phases of research • Mixing strategies • Time orientation • Priority of methodological approach
3) Develop strategies for collecting and analyzing mixed-methods data.	• Sampling design strategies • Data-collection strategies • Data-analysis strategies
4) Draw meta-inferences from mixed-methods results.	Inference decisions: • Types of reasoning
5) Assess the quality of meta-inferences.	• Inference quality
6) Discuss potential threats and remedies.	

Venkatesh et al. (2016) seem to slightly improve and extend Venkatesh et al. (2013).

2.10 Summary of approaches

In the traditional guidelines, there are no guidelines for literature reviews, although one is needed in almost every study. Therefore, we collect the traditional guidelines in Table 23 and hope that we find some ideas for literature reviews guidelines. Later, we pictorially relate traditional guidelines to methodological approaches.

Table 23 The traditional guidelines

Author(s)	**Methodology**	**Guidelines**
Benbasat et al. (1987) Eisenhardt (1989)	Positivist case study	Guidelines are not verbally presented in the original article; we propose the following:
Straub et al. (1994) Straub et al. (2004) Karahanna et al. (2018)	Positivist studies	I. Conceptual Significance II. Practical Significance III. Conduct of Research IV. Presentation of Research
Klein and Myers (1999)	Interpretive in depth case study and interpretive field study	1. The Fundamental Principle of the Hermeneutic Circle 2. The Principle of Contextualization 3. The Principle of Interaction between the Researchers and the Subjects 4. The Principle of Abstraction and Generalization 5. The Principle of Dialogical Reasoning 6. The Principle of Multiple Interpretations 7. The Principle of Suspicion
Hevner, March, Park and Ram (2004) March and Smith (1995)	Design science	1. Design as an artifact 2. Problem relevance 3. Design evaluation 4. Research contributions 5. Research rigor 6. Design as a search process 7. Communication of research
Davison et al. (2004, 2012)	Canonical action research	1. The Researcher-Client Agreement (RCA) 2. The Cyclical Process Model 3. The Theory 4. Change through Action 5. Learning through Reflection
Hirschheim (2008)	Conceptual research	1. Introduction 2. Content 3. Presentation and structure 4. Theoretical foundation 5. Data Analysis, interpretation and argumentation

		6. Results 7. Conclusions
Urquart et al. (2010)	Grounded theory studies	1. Constant comparison 2. Iterative conceptualization 3. Theoretical sampling 4. Scaling up 5. Theoretical integration
Myers and Klein (2011) Critical theories Bourdieu Foucault Habermas	Critical research	1. Using core concepts from critical social theorists 2. Taking a value position 3. Revealing and challenging prevailing beliefs and social practices 4. Individual emancipation 5. Improvements in society 6. Improvements in social theories
Venkatesh et al. (2013) Venkatesh et al. (2016)	Mixed methods	1. Decide on the appropriateness of a mixed-methods approach. 2. Develop strategies for mixed-methods research designs. 3. Develop strategies for collecting and analyzing mixed-methods data. 4. Draw meta-inferences from the mixed-methods results. 5. Assess the quality of the meta-inferences. 6. Discuss potential threats and remedies.

Almost all the methodologies in Table 23 concern empirical studies. Only Hirschheim thinks about conceptual (non-data) analysis. Therefore, studies exploring something that does not have a connection with the real world are lacking. This means mathematical and philosophical approaches. They must be analyzed in future studies.

Of the guidelines listed in the last column in Table 23, Hirschheim's (2008) contains some sequential steps; the others are quite different. Benbasat et al. (1987), unfortunately, do not include guidelines, although the authors promised them in the title and the abstract.

Straub et al. (1994) performed factor analysis for 15 items and perceived four standards corresponding factors:

1. Conduct of Research (replication, statistical/mathematical analysis, research design and scientific ethics),
2. Presentation (professional style, presentation style, length, logical rigor),
3. Conceptual Significance (coverage of significant literature, theory, suggest future research, contribution knowledge) and
4. Practical Significance (contribution to practice, topic).

If we drop the Presentation standard, we have three standards and their 10 items. It seems to be difficult to use standards because of their combination-type form. Therefore, we prefer 10 single items but they are, perhaps, too many

(cf. Miller 1956). In the text, Straub et al. (1994) focus on four criteria: 1) *contribution to knowledge,* 2) *coverage of significant literature,* 3) *logical rigor* and 4) *use of theory*. They seem to be good candidates for guidelines.

Klein and Myers' (1999) guidelines have good arguments, and Hevner et al. (2004) with March and Smith (1995) nicely follow Klein and Myers (1999). Hence, we propose only one new principle to Klein and Myers (1999): 8. The Principle of a Native's Worldview. Davison et al.'s (2004, 2012) guidelines have the canonical action research in the background. This means that there is a certain cycle (Susman and Evered 1978). Urquart et al. (2010) start with the basic book *The Discovery of Grounded Theory* (Glaser and Strauss 1967) and emphasize theory. Venkatesh et al. (2013, 2016) have guidelines that can be used in positivist (cf. Straub et al. 1994) and interpretivist (cf. Klein and Myers 1999) studies, respectively.

In summary, we cannot find any clear guiding principle for a literature review from the guidelines in Table 23.

Guidelines as methodological approaches

We also relate the traditional guidelines to an overview figure of research methods. We deleted the division between order and conflict (Burrell and Morgan 1979, Hirschheim and Klein 1989), which is similar to the division between consensus and dissensus (Deetz 1996), and we have Figure 12.

For Figure 12 we cite text from Järvinen (2012):

> we first differentiate other methods from mathematical methods, because they concern formal languages, algebraic units etc., in other words, symbol systems having no direct reference to objects in reality. From the rest of methods concerning reality we then use research questions in differentiation. Two classes are based on whether research question concerns what is a (part of) reality or does it stress on utility of an innovation. From the former we differentiate conceptual-analytical approaches, i.e. methods for theoretical development, from empirical research approaches. When we empirically study 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 we are developing a new theory grounded on the gathered raw data. This kind of description-driven research uses the perspective of an observer and operates in hindsight. ... Concerning innovations we can either build or evaluate them. The build-part of design (science) research uses the perspective of a player and in prevision intervention-outcome logic, and the outcome is later evaluated. We have above tried to apply the Bunge's (1967a) guidelines to the taxonomy. (Järvinen 2012, p. 9)

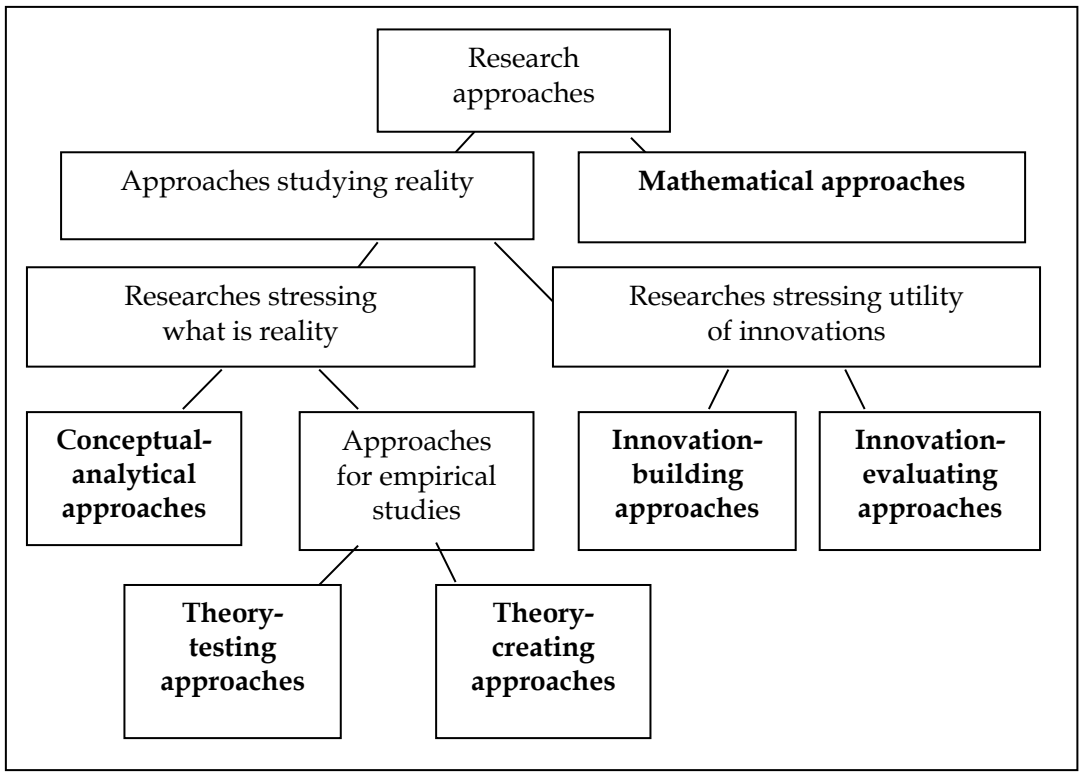

Figure 12 A taxonomy of research methods (derived from Järvinen 2012).

We now propose how the traditional guidelines (Table 23) can be seen to be close to a certain methodological approach (Figure 12): Straub et al. (1994) considered all studies positivist and especially field experiments, field studies and laboratory experiments as quantitative studies. They mainly are theory-testing approaches. Straub et al. (1994) consider case studies, conceptual studies and reviews/tutorials as qualitative studies. Case studies belong to theory-creating approaches, but the conceptual studies and reviews/tutorials shown in Figure 12 are categorized as conceptual-analytical approaches. Klein and Myers (1999) and Urquart et al. (2010) often developed new theories, and thus, they are close to theory-creating approaches. As we addressed above, mixed methods (Venkatesh et al. 2013, 2016) are either positivist (Straub et al. 1994) or interpretivist (Klein and Myers 1999). Hirschheim (2008) provides guidelines for conceptual research that are called conceptual-analytical approaches in Figure 12.

Hevner et al. (2004) and March and Smith (1995) gave guidelines for design research, and Davison et al. (2004, 2012) created guidelines for CAR that is similar to design research (Järvinen 2007a). We crystallized some similarities between these two methodologies in Sections 2.4 and 2.5.

For empirical studies in Figure 12, are theory-testing and theory-creating classes corresponding to the pair of "order and conflict" or "consensus and discensus". Above, it was presented Straub et al. (1994) for the theory-testing and Klein and Myers (1999) for the theory-creating class. The implicit assumption then was order / consensus. Myers and Klein's (2011) methodology is for the alternative "conclict / dissensus" because of its critical assumptions.

In addition to Klein and Myers (1999), case study and grounded theory most belong to the theory-creating class. Then, a researcher often names variables. Design science and action research move a system from the initial state to the final state, and a researcher then describes (names) states.

In Figure 12, there is a category for mathematical (and philosophical) approaches, but in Table 23, i.e., in our guidelines, there is no guideline for this category. Therefore, it must be included in future studies.

2.11 Writing

This section is based on Ojala and Lehner's (2018) work. Ojala is an editor of *Scandinavian Journal of Information Systems* (*SJIS*), and he and Lehner wanted to provide guidelines for writing a submission for *SJIS*. This article was written recently and covers a domain, writing, that some authors (in Sections 2.1 - 2.9) have considered. We present, evaluate and propose alternatives for the article.

Ojala and Lehner (2018)

This article has 11 sections: 1) Introduction to this commentary, 2) Blocks in academic writing: From the macro to the micro level, 3) Choosing the right title, 4) Writing an abstract, 5) Why the Introduction section matters most, 6) Reviewing and presenting the literature, 7) Writing the methodology section, 8) Writing the findings section, 9) Why the discussion is important, 10) Concluding and closing a paper and 11) Summing up and ways to move forward. They are divided into two groups: Sections 1 and 2, the others present recommendations for a certain part of a research article.

First, the article lacks an abstract and it is an omission that Ojala (2019) regretted. Concerning the first two sections in the Ojala and Lehner (2018) work, the Introduction is short, and the authors do not apply their Section 5 (Why the Introduction section matters most) to this article. Moreover, the goal of the paper is not stated in the Introduction. We would prefer such a goal as "our article must communicate when it is read only once." Ojala and Lehner (2018, Section 2, p. 6) state, that "The structure of a paper can be considered the macro level of your manuscript". We agree. The authors continue (p. 7) that the composition of an article, starting from the macro level, is typically structured as follows:

- Sections, such as introduction, methodology, or discussion (they are discussed in more detail in the remainder of this paper)
- Paragraphs, as the main blocks of argumentation
- Sentences, as the main block of meaning and
- Words, as the nuclei of any writing.

We see this structure positively, and as fun as we know, such a structure is seldom presented in IS literature. Another positive finding is that in this section, and in the almost all sections, the authors provide examples that help the reader

understand the authors' message. In addition, in almost every section, the main message is in the first sentence or in the first paragraph (cf. Barney 2018).

From title to conclusion

Sections 3 through 10 in Ojala and Lehner (2018) concern one part (often a section) after another in a research article. Generally, every section is needed, and it has important content. Next, we elaborate and evaluate the sections.

Ojala and Lehner state:

> The title is your showcase to the audience. It provides a first impression of your work to the reviewers and readers and should tell what your work is about at its core. Later, the title will also help other scholars to find your work through search engines and improves the possibility that the work will be cited in later studies on the topic. (Ojala and Lehner 2018, p. 10)

The title should refer to the content of the paper, and it is the shortest form of the article. The abstract, introduction, body of the paper and discussion are the four other parts of an article that form about the content of study. Moreover, researchers should try to avoid using the term "right" and similar terms, because such words contain reasons themselves.

Ojala and Lehner state:

> An abstract provides an overview of your study and signals its merits. Together with the title it sells your work by providing the first impression of your work to editors, reviewers, and readers. So, be sure that the impression they get is good. Generally, the abstract should include at least the following parts: (i) the aim of the study and why it is important, (ii) the research approach or method applied, and (iii) the main findings, conclusions, and contribution. (Ojala and Lehner 2018, p. 11)

We add the requirement that an abstract should be formulated in such a way that it communicates independently.

The authors name the next heading: "Why the Introduction section matters most". Ojala and Lehner confirm our finding that the Introduction directs most of the readers' attention to the whole article, and the Introduction presents the whole study in miniature. The authors present some elements that belong in the Introduction, e.g., a scientific reason for the study, the importance of the topic and either a quantitative or qualitative methodology. Concerning the order and the content, we prefer the following order for the Introduction: the importance, the scientific reason, the exact research question, the possible development of an instrument, the results and the division of the paper's other sections. Concerning the content, we prefer that the practical importance of the study domain is presented. For finding evidence for the reason for the study, we recommend, authors perform a literature review. Ojala and Lehner mention the gap and the problematization, but they continue with the gap only, although Sandberg and Alvesson (2011) merely recommend to change assumptions that Ojala and Leidner (2018) also appreciate. We and the authors prefer an exact research question derived from a research reason. The development of a new instrument, e.g., a new tool for a description and/or an analysis is completely lacking

in this article. The same is true for the results and the division of the rest of the paper.

A review of the literature is needed to justify a gap, but this kind of thinking is lacking in the authors' Section 6, although they recommend that all key concepts be introduced in this section. Okoli (2012) differentiates theory landscaping, theory testing and theory creating in a literature review, and theory landscaping is needed to justify a gap. Moreover, the authors seem to be unfamiliar with many publications concerning literature reviews, e.g., Boell and Cecez-Kecmanovic (2015) with the comment articles and many articles in *Communications of the Association for Information Systems* (2015) No 1, for example, Schryen (2015).

Ojala and Lehner state:

> Generally speaking, this part (Writing the methodology section) is easy to write as all that needs to be done is to tell the reviewers and readers what, how, and why you collected the material, and how it was analyzed. The most important thing to remember in the research method section is to give as much information as possible about your data, its origins, and its selection process. (Ojala and Lehner 2018, p. 16)

The authors seem to take the concept "data" for granted, but Jones (2019) differentiates many aspects of data, for example, data to be a referential, natural, foundational, objective and equal representation of the world and a new expression of some data; big data to be as revolutionary, voluminous, universal or exhaustive.

The authors consider very few methods (almost only quantitative and qualitative ones) and thus, many important methods in IS, such as design science, action research, engaged scholarship and research in practice, are lacking. Ojala (2019) explains that

> the paper could include more methods. However, we as authors were the most familiar and experienced with qualitative and quantitative methods so other methods were neglected. Further, we felt that inclusion of several methods would make the section unnecessary long. (Ojala 2019)

Ojala and Lehner write:

> The findings section might be challenging as there is no one single correct way to write the findings. Usually, findings are presented as such and then elaborated upon through a comparison with the literature in the discussion section. However, sometimes findings and discussions are written together to avoid too much overlap. The main goal of the section is to provide precise answers to your research aims, problems, questions, or hypotheses as presented earlier in the paper, besides the necessary additional robustness tests that will provide insights into the robustness of your findings. (Ojala and Lehner 2018, p. 17)

Separating the findings and discussion sections emphasizes the results of a study, but combining the sections may avoid writing the same facts twice. Thus, a comparison of previous and new results plays a central role (Nissen 1998).

Ojala and Lehner write that:

> One aim in the discussion section is therefore to explain how and why your findings are either in line or inconsistent with the literature. (Ojala and Lehner 2018, p. 19)

The authors do not separate scientific and practical results, but they consider whether the (scientific) results of the study perhaps support or conflict with previous knowledge in the literature. Concerning the support alternative, Colquitt and Zapata-Phelan (2007, p. 1303) state that "replications of previously published work and very incremental research rarely offer enough of a contribution to warrant publication". At the same time, the authors almost forget results that are novel. Such results are mostly appreciated in the literature. Concerning conflicting results, we prefer that a new result is slightly speculated with a comment that, perhaps, such and such reasons may explain the conflicting results.

Ojala and Lehner (2018, p. 20) state:

> The aim of the conclusion section is to summarize your key findings and the contribution of the study. Sometimes, authors write this content in a joint section with the discussion to avoid unnecessary repetition. (Ojala and Lehner 2018, p. 20)

We also prefer that the Discussion and Conclusion sections are separate. However, we emphasize that the Conclusion section should contain only the most important results of the study and nothing more. We recommend that implications for practice, limitations and proposals for new research, which authors currently place in the Conclusion section, be presented in the Discussion section. Then the Conclusion section ends the study with positive views, that is, with new results.

Summary

We crystallize Ojala and Lehner's (2018) message as follows:

1. We like many of their recommendations, e.g., a connection between previous and forth-coming paragraphs (a story) with many descriptive and helpful examples.
2. We appreciate the structure of a text.
3. We would demand an abstract section for each article.
4. We propose several alternatives to some sections with good arguments.
5. We prefer that the first sentence at the beginning of each section introduces a reader to the discussion at hand.

3 LITERATURE REVIEW

Webster and Watson state:

> A review of prior, relevant literature is an essential feature of any academic project. An effective review creates a firm foundation for advancing knowledge. It facilitates theory development, closes areas where a plethora of research exists, and uncovers areas where research is needed. (Webster and Watson 2002, p. xiii)

Templier and Paré broaden this view:

> By synthesising or integrating previous knowledge as well as offering foundations for further research, literature reviews play a critical role in the development of science (Paré et al., 2015; Rowe, 2014). (Templier and Paré 2018, p. 503)

The research papers summarized in the review are referred to as primary studies, while the review is a secondary study (Brereton et al. 2007). Templier and Paré differentiate:

> A literature review might appear either as the background for an empirical study or as a standalone piece that provides a valuable contribution in its own right (Okoli & Schabram, 2010). The former is the most common form of literature review (Hart, 2001). The latter, also called standalone literature review or review article, is an independent paper whose purpose is to synthesize the extant literature in a field without collection of empirical data. (Templier and Paré 2018, p. 503)

In Section 3.1, we analyze papers that include different methods for literature reviews of primary studies. We give examples of good ones. We also pay attention to systematic reviews. In Section 3.2, we consider various groupings of different literature reviews (the literature review as a secondary study) and their problems. In Section 3.3, we cite Schryen et al. (2020) and their knowledge development perspective with six activities. We analyze one activity, a gap, further.

3.1 Methodology for developing a literature review

We want to develop guidelines for literature reviews. Thus, in this section we analyze methodologies for literature reviews and collect them.

Rowe (2014) performed a literature review with Besson on strategizing information systems-enabled organizational transformation (2012) and then as an editor, prepared directions for literature reviews. Rowe broadened our view by citing (2014, p. 242) Schwarz and colleagues (2006) who classify literature review goals as follows:

1. to summarize prior research,
2. to critically examine contributions of past research,
3. to explain the results of prior research found within research streams,
4. to clarify alternative views of past research (not necessarily integrated together).

Almost all articles concerning literature reviews cite Webster and Watson (2002). However, they do not provide a set of steps for reviewing. Instead, Levy and Ellis (2006) define literature review process as:

> sequential steps to collect, know, comprehend, apply, analyze, synthesize, and evaluate quality literature in order to provide a firm foundation to a topic and research method. (Levy and Ellis 2006, p. 182)

The process model seems to follow Bloom's (1956) taxonomy. To our mind, Levy and Ellis (2006) present one of the best set of directions for performing a literature review. Their set of steps is suitable for a guideline.

Brereton et al. (2007) give a 10-stages model in software engineering: 1) Specify the research questions, 2) Develop the review protocol, 3) Validate the review protocol, 4) Identify relevant research, 5) Select primary studies, 6) Assess the study quality, 7) Extract the required data, 8) Synthesize the data, 9) Write the review report, and 10) Validate the report.

Okoli (2012) provides a critical realist guide to developing theory with systematic literature reviews (see Table 24).

Table 24 General steps of a systematic review (adapted from Okoli and Schabram 2010)

Purpose of the review	Specify general objectives, research questions, and dissemination strategy
Protocol and training	Prepare a protocol (plan) for the review, and train the review team
Practical screen	Decide on which kinds of articles to search for, and which to not even consider
Literature search	Conduct actual search for relevant articles
Data extraction	Read articles and extract pertinent information from them as material for the review
Quality appraisal	Evaluate the quality of articles identified

Synthesis	Use a chosen approach to combine and analyze studies, and synthesize composite meanings from them
Writing the review	Write up the review and draw conclusions from the synthesis

Wolfswinkel et al. (2013, p. 47) consider that a shorter method (five stages) is enough if we remember to use iteration: 1) Define, 2) Search, 3) Select, 4) Analyze and 5) Present.

Schryen (2015) analyzes how to write qualitative IS literature reviews. He gives guidelines for synthesizing, interpreting and guiding the research. He proposes nine steps (p. 294): 1) Motivation, uniqueness, goal(s), structure, 2) Scope and boundaries, 3) Literature search, 4) Literature assessment, 5) Description of concepts, 6) Literature presentation, 7) Identification of research gaps, adoption of a new perspective, and/or theory building, 8) Research agenda, research propositions or questions and related paths and 9) Summary, implications for research and practice, limitations. We strongly recommend this article as a guideline for literature reviews.

Boell and Cecez-Kecmanovic write:

> General guidelines for conducting literature reviews often do not address the question of literature searches and dealing with a potentially large number of identified sources. These issues are specifically addressed by so-called systematic literature reviews (SLRs) that propose a strict protocol for the search and appraisal of literature. (Boell and Cecez-Kecmanovic 2015, p. 161)

To our claim that: SLRs seems to be based on the evidence-based medicine movement, Boell replies:

> For the rhetoric of systematic reviews to hold there needs to be a closed research question that can be answered by surveying the evidence available in the literature. (Boell 2015, p. 82)

Boell and Cecez-Kecmanovic (2015) continue that:

> Moreover, SLRs are claimed to be a "standardized method" for literature reviews that is replicable, transparent, objective, unbiased and rigorous, and thus superior to other approaches for conducting literature reviews. These are significant and consequential claims that – despite increasing adoption of SLRs – remained largely unnoticed in the information systems (IS) literature. (Boell and Cecez-Kecmanovic 2015, p. 161)

Later, they state (p. 167):

> SLRs' claims to scientific objectivity, transparency, replicability and rigor as essential qualities of literature reviews significantly differ from those established in the literature on traditional literature reviews (see Tables 1 and 2). (Boell and Cecez-Kecmanovic 2015, p. 167)

We do not copy their Table 1 but present their Table 2 that contains important criteria and their descriptions of all literature reviews as Table 25.

Table 25 Criteria for good literature review practice (Boell and Cecez-Kecmanovic 2015, p. 168)

Criteria	References
Comprehensiveness of literature, breadths and depths of understanding – Literature review process is an understanding process that involves searching for literature, selecting, reading, comparing, classifying and critically assessing earlier research, leading to the creation of a body of literature relevant for a phenomenon studied; literature reviews are assessed based on the comprehensiveness of and insight into the body of literature analyzed and breadth and depths of its understanding	Boote and Beil (2005); Hart (1998); Perry (1998); Schwarz et al. (2007); Webster and Watson (2002)
Argument development – The aim of literature reviews is to develop a solid argument by assessing prior research and contributions to knowledge of specific papers/streams/ approaches, and based on that, identify weaknesses, under-researched phenomena or research gaps that warrant further research	Feak and Swales (2009); Kwan et al. (2012); Levy and Ellis (2006); Machi and McEvoy (2012); Ridley (2008)
Ongoing engagement – Literature reviews are complex iterative processes through which a researcher acquires ever increasing understanding of the relevant literature and a potential to contribute to the literature; with broader and deeper understanding of literature, a researcher's ability to assess relevance and value of individual studies, streams of research and different domains of literature are increasing; literature reviews are therefore integrative to the complete research process, as engagement with the literature informs all stages of research, up until the final write up	Combs et al. (2010); Dellinger (2005); Dong (1996); Goodfellow (1998); Kwan (2008); Onwuegbuzie et al. (2007); Ridley (2008); Wolfswinkel et al. (2013)
Criticality – Central to the quality of literature reviews is the critical engagement with knowledge claims made by earlier research and the assumptions underlying these knowledge claims; high quality literature reviews are characterized by criticality of assessment of existing knowledge about a target phenomenon, including contributions of specific approaches and streams of research	Alvesson and Sandberg (2011); Finn (2005); MISQ (2006); Ridley (2008)
Originality and innovative views – Literature reviews are judged by the novelty in approaching and investigating earlier research that brings out a researcher's voice. The aim is the generation of new insights, perspectives and understanding by problematizing knowledge claims, approaches and assumptions in earlier research	Alvesson and Sandberg (2011); Green et al. (2006); Hart (1998); Khoo et al. (2011); MacLure (2005)

This collection of the methods for conducting literature reviews shows that this task is important. There are many different approaches. Levy and Ellis (2006) and Schryen (2015) seem to provide the most thorough descriptions for this task (*our guidelines* for literature review).

It is important to observe a division of goals in a study: 1) what is a part of reality (truth) and 2) what is a utility of a new system. All the studies seeking truth are taken to LR, and also a part of design science (DS) and action research

(AR) studies where focal theories are used. However, a part of DS and AR studies concerning utility is rarely included into LR because of many different utility measures.

3.2 Facilitation of the development of a literature review by classification

In this section, we collect attempts to describe and classify literature reviews and seek ad hoc classification of reviews. Webster and Watson (2002) followed the development of different domains and their studies. The authors find that:

> As fields of inquiry develop, their theories are often placed on a hierarchy from ad hoc classification systems (in which categories are used to summarize empirical observations), to taxonomies (in which the relationships between the categories can be described), to conceptual frameworks (in which propositions summarize explanations and predictions), to theoretical systems (in which laws are contained within axiomatic or formal theories). (Webster and Watson 2002, p. xiii)

In this section, we analyze how high in the hierarchy some researchers achieve in classification of literature reviews.

Although Webster and Watson (2002) emphasize concepts in literature reviews, we prefer to analyze literature reviews as units and their similarities and differences, i.e., types of reviews. In our consideration of groupings or classifications of literature reviews, we find that Kitchenham et al. (2009) emphasize evidence-based argumentation, and Booth et al. (2012) differentiate different reviews. Rowe (2014), Paré et al. (2015) and Templier and Paré (2018) form a certain group of articles and emphasize goals. Rowe proposes three goals, Paré et al. nine goals, and Templier and Paré enlarge Rowe's three goals to four and re-classify nine types as these four goals.

We present Kitchenham et al. (2009) and Booth et al. (2012) as promising attempts and perform a deeper analysis for the latter three approaches. We structure this section according to the sources: Kitchenham et al. (2009), Booth et al. (2012), Rowe (2014), Paré et al. (2015) and Templier and Paré (2018).

Kitchenham et al. (2009)

Kitchenham et al. describe their literature review in their abstract:

> *Background:* In 2004 the concept of evidence-based software engineering (EBSE) was introduced at the ICSE04 (International Conference on Software Engineering) conference.
> *Aims:* This study assesses the impact of systematic literature reviews (SLRs) which are the recommended EBSE method for aggregating evidence.
> *Method:* We used the standard systematic literature review method employing a manual search of 10 journals and 4 conference proceedings.
> *Results:* Of 20 relevant studies, eight addressed research trends rather than technique evaluation. Seven SLRs (Systematic Literature Review) addressed cost estimation. The quality of SRLs was fair with only three scoring less than 2 out of 4.
> *Conclusions:* Currently, the topic areas covered by SLRs are limited. European researchers, particularly those at the Simula Laboratory appear to be the leading exponents of sys-

> tematic literature reviews. The series of cost estimation SLRs demonstrate the potential value of EBSE for synthesizing evidence and making it available to practitioners. (Kitchenham et al. 2009, p. 7)

The goal of Kitcheham et al.'s review is to assess systematic literature reviews (which are referred to as secondary studies). Thus, their study is categorized as a tertiary literature review, and the authors follow the evidence-based medicine movement, because in software engineering evidence-based consideration is highly appreciated. However, in information systems, there are few studies where evidence-based reasoning can be found. It may be based on the existence of people as necessary actors in information systems. People's behavior cannot be predicted with 100 % accuracy.

Booth et al. (2012)

Bandara et al. describe one of the first taxonomies as follows:

> Literature can be reviewed in many different ways. Booth, Papaioannou, and Sutton (2012) identify types, approaches, terms, and philosophical lenses commonly used for reviews. Table 1 [Table 26] summarizes the six different types of reviews they outline. Most literature reviews will include content that can belong to several of these categories; thus, the categories are not mutually exclusive. For example, category 1 (literature review) is the most generic category. At the same time, while doing a generic literature review, one can choose to use a critical lens (category 2) for examining recent literature, map the citations (category 4) to illustrate the evolution of the area of focus, and/or bring meta data into the analysis and reporting (category 5 to, for example, illustrate trends. (Bandara et al. 2015, p. 156)

Table 26 Types of reviews (adapted from Booth et al., 2012, p. 26) (Bandara et al. 2015, p. 156)

Type of review	Description
Literature review	Examines recent or current literature. Can cover a wide range of subjects at various levels of completeness and comprehensiveness. May include research findings.
Critical review	Demonstrates extensive research and critical evaluation of quality. Goes beyond merely describing to include degree of analysis and conceptual innovation. Typically results in hypothesis or model.
Integrative review	Includes both experimental and non-experimental research for a more comprehensive understanding of a phenomenon. Integrative reviews may combine data from theoretical and empirical literature.
Mapping review/ systematic map	Identifies gaps in research literature by mapping and categorizing existing literature to commission further reviews and/ or primary research
Meta-analysis	Statistically combines results of prior quantitative studies.
Mixed studies review/ mixed methods review	Combines methods that include the review component (usually systematic). Specifically, the combination of review approaches (e.g., quantitative with qualitative research or outcome with process studies).

Bunge (1967) demands a good classification system in which categories are pairwise disjoint, but as the authors above write: "the categories are not mutual-

ly exclusive." Bunge sees that the resolution power of the classification is higher when categories are pairwise disjoint than when they overlap.

Rowe (2014)

Rowe (2014) seeks "a typology of literature reviews based on research goals." Nickerson et al. considered that:

> classification scheme, taxonomy, and typology are often used interchangeably. Gregor (2006, p. 623) echoes this thought, stating that "the term typology is used more or less synonymously for taxonomy and classifications". (Nickerson et al. 2013, p. 338)

This citation shows that we still have much work with concepts we use. We use the term "classification."

According to Rowe,

> the goal with respect to theory, we mainly distinguish three main types: reviews for describing, for understanding and for explaining. ... In fact, Gregor (2006) distinguishes four main types of theoretical goals: "analysis and description", "explanation", "prediction", "prescription". The latter is a special case of prediction. Not only is it well-known that prediction is very difficult in the social world, because it is an open system, but literature reviews rarely espouse this goal. Therefore, we will retain only three types of goals with respect to theory. (Rowe 2014, p. 243)

Thus, Rowe perceives three genres and names them: describing, understanding and explaining. We use the term "genre," because Templier and Paré (2018) later use the same term. Rowe defines three (actually four) genres in his editorial.

Rowe defines:

> Thus, some reviews aim at *describing* a phenomenon with little or no contribution to theory. Those summarize, under very general categories such as organizational, technical and environmental, the often very empirical literature that has been produced on the topic under investigation. Sometimes such reviews also detail the broader categories to emphasize more conceptual relationships (e.g. Wiener et al, 2010), but without discussing categorical assumptions and underlying assumptions.
>
> Other literature reviews aim at *understanding* a new phenomenon or problem through related concept(s) that have been proposed in former research. Those generally adopt a narrative style to make sense of the content of the literature. (Rowe 2014, p. 244)
>
> When the review aims at *explaining* it is fundamentally concept-centric (Webster & Watson, 2002), moving away from paper-centric or author-centric approaches, which do not allow to compare very systematically which concepts and underlying dimensions or categories are part of which paper in a given set of concepts belonging to a framework. (Rowe 2014, p. 245)
>
> Finally the *theory testing* review, more well-known as meta-analysis, is based exclusively on a quantitative approach to empirical papers, which have themselves followed a quantitative approach and reported their results in a sufficiently precise and rigorous way so that they can be taken as an input of a model that takes all this previous knowledge into account to statistically test and examine what remains robust overall (King & He, 2005). This type of review makes some sense when a lot of studies have used the same base theory or model, such as the technology acceptance models (cf. King & He, 2006; Wu & Du, 2012). Another type of theory testing review can also include qualitative empirical papers in addition to the quantitative ones but it cannot be strictly considered as a meta-analysis (e.g. Lacity et al, 2010). (Rowe 2014, p. 246)

Gregor (2006, p. 619) states that the four primary goals of theory discerned are: 1) Analysis and description, 2) Explanation, 3) Prediction and 4) Prescription. She continues:

> Combinations of these goals lead to the five types of theory shown in the left-hand column of Table 2 [Table 27]. The distinguishing features of each theory type are shown in the right-hand column. (Gregor 2006, p. 619)

Table 27 A taxonomy of theory in information systems research (Gregor 2006, p. 620)

Theory Type	**Distinguishing Attributes**
I. Analysis	Says what is. The theory does not extend beyond analysis and description. No causal relationships among phenomena are specified and no predictions are made.
II. Explanation	Says what is, how, why, when, and where. The theory provides explanations but does not aim to predict with any precision. There are no testable propositions.
III. Prediction	Says what is and what will be. The theory provides predictions and has testable propositions but does not have well-developed justificatory causal explanations.
IV. Explanation and prediction (EP)	Says what is, how, why, when, where, and what will be. Provides predictions and has both testable propositions and causal explanations.
V. Design and action	Says how to do something. The theory gives explicit prescriptions (e.g., methods, techniques, principles of form and function) for constructing an artifact.

In Table 27, there are the distinguishing attributes of theory defined by Gregor. Rowe's descriptions of three or four genres are not strictly distinguishing; they mostly emphasize the main theoretical goals.

Paré et al. (2015)

Paré et al. (2015, p. 183) developed a typology of review types and provides descriptive insight into the most common reviews found in the top IS journals. The authors collected 139 literature review studies from good IS journals. Based on the articles, the authors perceived six types which they supplemented from different sources for the following nine types: narrative review, descriptive review, scoping review, meta-analysis, qualitative systematic review, umbrella review, theoretical review, realist review, (hybrid review) and critical review (Paré et al. 2015, Table 2, p. 186).

Paré et al. (2015) explain the background of their classification as follows:

> By carefully reading through the detailed descriptions provided in the selected sources, we collectively identified nine literature review types and extracted seven recurrent first-order constructs (dimensions) most often used to distinguish between review types (see Table 2 [Table 28]). These first-order constructs are (1) the overarching goal of the review, (2) the scope of the review question, (3) the search strategy, (4) the nature of the primary

> sources included in the review, (5) the explicitness of the study selection, (6) the quality appraisal, and (7) the methods for synthesizing/analyzing findings. (Paré et al. 2015, p. 184)

We make two terminological notes. First, Paré et al. write:

> To circumvent these limitations, Pawson et al. [55] have developed a new approach to synthesizing prior knowledge that seeks to unpack the mechanism of how 'complex interventions' work (or why they fail) in particular contexts or settings. This form of synthesis involves a *critical realist* [our italics] approach. Realism is a methodological orientation that has its roots in philosophy and applications in fields such as sociology, psychology and economics [90]. Under realism, the basic evaluative question of what works changes to 'what is it about this intervention that works, for whom, in what circumstances, in what respects and why?' (Paré et al. 2015, p. 189)

The authors used the expression "critical realist approach". The term "critical" can be firmly associated with the term "realist". Mingers et al. (2013) consider 'critical realism' as a philosophical approach. But Paré et al. (2015) are not interested in philosophies of science in their article. The term 'critical' can have the meaning of a general criticism, and we consider this meaning in the next paragraph.

Second, Paré et al. define that critical

> reviews aim to *critically* [our italics] analyze the extant literature on a broad topic to reveal weaknesses, contradictions, controversies, or inconsistencies [34, 82, 94]. (Paré et al. 2015, p. 189)

Paré et al.'s meaning of critical is close to Hirschheim's (2008) view (Section 2.6) on critical; that is, the authors critically consider texts of primary studies. Paré et al. later write:

> critical reviews can apply a variety of data synthesis methods that can be grouped as either positivist (e.g., content analysis) or interpretivist (e.g., meta-ethnography, critical interpretive synthesis) according to the authors' epistemological positions. (Paré et al. 2015, p. 189)

Paré et al. then take two perspectives from philosophy of science (positivist and interpretivist); cf. Chua (1986). They clearly differentiate between critical consideration of a text and a critical review of primary studies, and between these two and the critical perspective (Chua 1986).

Table 28 Typology of literature review types (Paré et al. 2015, p. 186)

Over-arching goal	Theoretical review types	Scope of questions	Search strategy	Nature of primary sources	Explicit study selection	Quality appraisal	Methods for synthesizing / analyzing findings
Summarization of prior knowledge	Narrative review	Broad	Usually selective	Conceptual and empirical	No	No	Narrative summary
	Descriptive review	Broad	Representative	Empirical	Yes	No	Content analysis/ frequency analysis
	Scoping review	Broad	Comprehensive	Conceptual and empirical	Yes	Not essential	Content or thematic analysis
Data aggregation or integration	Meta-analysis	Narrow	Comprehensive	Empirical (quantitative only)	Yes	Yes	Statistical methods (meta-analytic techniques)
	Qualitative systematic review	Narrow	Comprehensive	Empirical (quantitative only)	Yes	Yes	Narrative synthesis
	Umbrella review	Narrow	Comprehensive	Systematic reviews	Yes	Yes	Narrative synthesis
Explanation building	Theoretical review	Broad	Comprehensive	Conceptual and empirical	Yes	No	Content analysis or interpretive methods
	Realist review	Narrow	Iterative and purposive	Conceptual and empirical	Yes	Yes	Mixed-methods approach
Critical assessment of extant literature	Critical review	Broad	Selective or representative	Conceptual and empirical	Yes or no	Not essential	Content analysis or critical interpretive methods

In the second column of Table 28 (Paré et al. 2015, p. 186), there are nine types of literature reviews. In the first column, there are four "super-types": 1) Summarization of prior knowledge, 2) Data aggregation or integration, 3) Explanation building and 4) Critical assessment of extant literature. When the four super-types (Paré et al. 2015) and Rowe's (2014) describing, understanding and explaining are compared, Rowe's describing can contain Paré et al.'s narrative review and descriptive review, and Rowe's explaining can contain Paré et al.'s theoretical review and realist review. We conclude that these two classifications are similar and as well as different.

Templier and Paré (2018)

Templier and Paré describe their study in the abstract as follows:

> The central role of information systems review articles has been recognised in a recent explosion of interest in editorials, research articles, and opinion papers investigating methods and approaches for conducting standalone reviews. In continuity with recent developments in this area, this descriptive review seeks to determine the extent to which various types of review articles published in our field are transparent, i.e., they report important methodological elements about their design. To fulfill this objective, we identified, classified, and coded 142 review articles from the Association for Information Systems (AIS) senior scholars' basket of journals published between 2000 and 2014. (Templier and Paré 2018, p. 503)

The authors compare their own classification with the two described above:

> One way of classifying IS literature reviews was recently proposed by Rowe (2014). His taxonomy distinguishes four broad genres of reviews according to their primary goal with respect to theory, namely, describing, understanding, theory testing, and explaining. For their part, Paré and colleagues (2015) reviewed the extant literature on literature reviews to come up with a typology that identifies, defines, and contrasts nine distinct types of review articles. In the paragraphs below, we explain these two classification schemes and how they complement each other (see Table 1 [Table 29]). (Templier and Paré 2018, p. 505)

Table 29 Classification of information systems review types (Templier and Paré 2018, p. 505)

Primary goals of reviews with respect to theory (Rowe, 2014)	Literature review types (Paré et al. 2015)	Examples of IS-related reviews
Describing	Narrative Descriptive	Chan and Reich (2007) Avison et al. (2008)
Understanding	Scoping Critical	Smith et al. (2011a) Schryen (2013)
Testing theory	Meta-analysis Qualitative systematic Umbrella	Ortiz de Guinea et al. (2012) Petter et al. (2008) Kitsiou et al. (2015)
Explaining	Theory development Realist	von Krogh et al. (2012) Wong et al. (2010)

Templier and Pare (2018) derived a six-step method for considering literature reviews:

Step 1. Problem formulation
Step 2. Literature search
Step 3. Screening for inclusion
Step 4. Quality assessment
Step 5. Data extraction
Step 6. Data analysis and interpretation

They evaluate literature reviews under study by using their method. For example, Step 4 (quality assessment) was applied in theory testing studies only. Although this article and the method above have some advantages, we still doubt them due to some minor misprints or failures in Templier and Paré (2018); see Järvinen (2019, p. 5).

Comparison of articles: Rowe (2014), Paré et al. (2015), and Templier and Paré (2018)

We have some comments:

1. When we compared the first column with Rowe's (2014) three genres (describing, understanding and explaining) we find that Templier and Paré added a type, called theory testing. The authors are right that Rowe (2014, p. 246) writes: "Finally the *theory testing* review, more well-known as meta-analysis, is exclusively based on a quantitative approach to empirical papers" but he did not include the fourth type in his list of types (T&P genres). (T&P = Templier and Paré).
2. Another terminological difference is that Templier and Paré called Rowe's (2014) classification as taxonomy, but it is not such one in Webster and Watson's (2002) meaning.
3. Rowe (2014) states: "The theory building type of review encompasses those that aim at explaining, whereas some reviews for understanding may also be theory building (e.g., Jasperson et al., 2002)" (p. 246). This means that those four genres are not pairwise disjoint; i.e., they overlap or at minimum, researchers have difficulty classifying a certain literature review into one and only one genre.
4. We repeat Rowe (2014) (p. 243): "literature reviews according to their main theoretical goal or type of contribution to theory. In fact, Gregor (2006) distinguishes four main types of theoretical goals: 'analysis and description', 'explanation', 'prediction', 'prescription'. The latter is a special case of prediction. Not only is it well-known that prediction is very difficult in the social world, because it is an open system, but literature reviews rarely espouse this goal. Therefore, we will retain only three types of goals with respect to theory."
   Rowe (2014) seems to use the same verbalization in his article as Gregor (2006). Rowe (2014) then states: "The latter (prescription) is a special case of prediction". But actually Gregor (2006, Table 2, p. 620) differentiates five

main types of theory: "I analysis, II explanation, III prediction, IV explanation and prediction (EP), V design and action." Prescription does not seem to be a special case of prediction, because in prediction theory describes a *repetitive* action. However, in Sections 2.4 and 2.5, we describe a change that hopefully will happen *once* and in a positive case, moves a system from an initial state to a goal or final state. At the end of Section 3.1, it was demonstated that in LR methods there is *no LR method for design science and action science studies* (prescription) thus far.

5. In connection with item 1), we recognized Rowe's (2014) genres (describing, understanding and explaining) and how Templier and Paré add a type, theory testing. We see that there are two approaches of the same kind to analyzing a certain domain in reality: (a) qualitative or exploratory or a new theory creating and (b) quantitative or confirmatory or theory testing. Rowe (2014) seems to follow alternative (a) and Templier and Paré (2018) alternative (b). Rowe's sequence: describing, understanding, explaining follows Gregor's (2006) types I, II and IV, and Templier and Paré take type III more. Type V (design and action) emphasizes a system's utility, not truth as in types I ... IV. An essential characteristic of Type III (prediction) is theory as a black box but in Type IV as white box.

The articles by Kitchenham et al. (2009), Booth et al. (2012), Rowe (2014), Paré et al. (2015), and Templier and Paré (2018) are positive in the sense that the authors want to develop a classification for literature reviews. Booth et al. (2012), Rowe (2014) and Templier and Paré (2018) seem to strive for a smaller number of genres than Paré et al. (2015). Their goal then supports Miller (1956) and his magic number seven. Miller emphasizes that a human being has short- and long-term memory and the maximum capacity of short-term memory is 7 +/- 2 units.

3.3 One of the many uses of a literature review

In this section, we consider knowledge-building generally and then gap-spotting spefically.

3.3.1 Knowledge-building

Schryen et al. (2020) derive knowledge-building activities from the literature review and form a conceptual framework. Schryen et al. consider that:

> Figure 1 [Figure 13] visualizes the six knowledge-building activities and aligns our knowledge-based perspective on LRs with the methodological and goal perspectives. It shows that one can perceive knowledge-development activities as an 'intermediate layer' that explains how LRs achieve goals by applying different methodologies. Therefore, the knowledge-building activities build on established methodologies. (Schryen et al. 2020, p. 139)

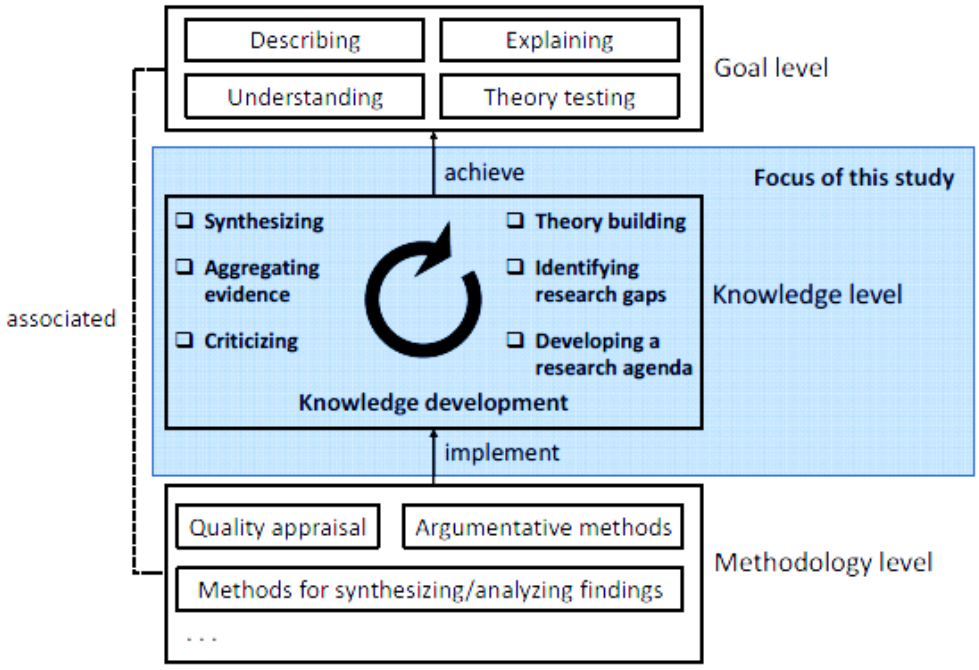

Figure 13 Conceptual framework (Schryen et al. 2020, p. 140)

Rowe (2014), Paré et al. (2015) and Templier and Pare (2018) develop four goals (describing, understanding, explaining and theory testing) and Schryen et al. (2020) identify six knowledge-building activity styles (SYN: Synthesizing, AE: Aggregating evidence, CRI: Criticizing, TB: Theory building, RG: Identifying research gaps, RA: Developing a research agenda). The first three (SYN, AE and CRI) are backward oriented and the last three (TB, RG and RA) forward oriented. The first three activities almost immediately build new knowledge from literature reviews, but we must show evidence from empirical studies for last three activities, for example, for gaps found in the literature.

Next, we analyze gap-spotting in a bit more detail.

3.3.2 Gap-spotting

We accept that gap-spotting is a common way to show a need for studies. In the article "Ways of constructing research questions: gap-spotting or problematization?" Sandberg and Alvesson (2011) focus on:

> how researchers construct research questions from existing literature. (Sandberg and Alvesson 2011, p. 24)

They cite the following:

> According to their study (Locke and Golden-Biddle, 1997), establishing opportunities for contributions includes two main processes, namely, structuring intertextual coherence and problematization. (Sandberg and Alvesson 2011, p. 26)

In this way, they perceived two groups for the construction of the research question: gap-spotting and problematization. We mainly consider gap-spotting by using Sandberg and Alvesson's table; see Table 30. We shortened the table (Sandberg and Alvesson 2011) by leaving out some references. We explain this table principally by citing Sandberg and Alvesson's text.

Table 30 Basic modes of gap-spotting and their specific versions (Sandberg and Alvesson 2011, Table 1, pp. 28-29)

Basic gap-spotting modes	Specific versions of basic gap- spotting modes	Reviewed journal articles
Confusion spotting	Competing explanations	Anderson and Reeb (2004). *ASQ* 49(2): 209–237, Burnes (2004). *JMS* 41(6): 977–1002, ...
Neglect spotting	Overlooked area Under-researched Lack of empirical support	Arend (2004). *JMS* 41(6): 1003–1027, Brown (2004). *OS* 25(1): 95–112, ... Balogun and Johnson (2005). *OS* 26(11): 1573–1601, Baum et al. (2005). *ASQ* 50(4): 536–575, ... Dyck et al. (2005). *JMS* 42/2: 387–416, Tyrrell and Parker (2005). *JMS* 42/3: 507–537
Application spotting	Extending and complementing existing literature	Clegg and Courparsson (2004). JMS 41/4: 525–547, Hancock (2005). ORG 12/1: 29–52,...

There are three basic gap-spotting modes: confusion spotting, neglect spotting and application spotting. Sandberg and Alvesson explain the different types of gap-spottings:

> The main focus in this way of constructing research questions is to spot some kind of *confusion* [our italics] in existing literature. Previous research on the topic exists, but available evidence is contradictory. The research question aims to sort out the identified confusion in the literature and to explain it. The main version of this mode of constructing research questions was to search for competing explanations in existing literature. (Sandberg and Alvesson 2011, p. 29)

> Spotting something *neglected* [our italics] in existing literature is the most common mode of constructing research questions in our sample. It tries to identify a topic or an area where no (good) research has been carried out. There is virgin territory—a white spot on the knowledge map—that produces an imperative for the alert scholar to develop knowledge about the neglected area(s). It is possible to distinguish three specific versions of neglect spotting, namely, spotting an overlooked area, an under-researched area and a lack of empirical support. (Sandberg and Alvesson 2011, p. 30)

> Spotting a new *application* [our italics] in existing literature is a third basic mode of constructing research questions. It searches mainly for a shortage of a particular theory or perspective in a specific area of research. The research task is to provide an alternative perspective to further our understanding of the particular subject matter in question. Typically, advocates of application spotting claim that a specific body of literature needs to be extended or complemented in some way or another. An example of this version can be found in Watson's (2004) study 'HRM and critical social science analysis'. He reviews existing HRM literature and concludes that it lacks a more critical perspective. Too much of the HRM literature is prescriptive and normative. In order to address this inadequacy,

> Watson's research task is to introduce a critical theory perspective into current HRM literature. (Sandberg and Alvesson 2011, pp. 30-31)

Finally, Sandberg and Alvesson give the example of Schultz and Stabell (2004) and state:

> While many of the studies reviewed emphasize one major way of constructing research questions, combinations of different gap-spotting ways are not uncommon. (Sandberg and Alvesson 2011, p. 31)

Sandberg and Alvesson continue:

> while gap-spotting means identifying various gaps in existing literature (e.g. confusion, neglect and application spotting), it does not actively challenge the assumptions underlying existing theory. Problematization, on the other hand, is about challenging assumptions which underlie existing theory in some significant ways. When some important assumptions are problematized, this becomes an opportunity for critical insights and new ideas of a more radical character. (Sandberg and Alvesson 2011, p. 33)

Sandberg and Alvesson propose four approaches to problematization: critical confrontation, new idea, quasi-problematization and problematization. We do not consider them in more detail, although recently Leidner (2018), by referring to Sandberg and Alvesson (2011), indicates the high importance of assumptions behind theory in a study. She is very enthusiastic about problematization. In addition, she took the example of the two important roles of CEO and CIO often being considered similar, although they are quite different. Leidner clearly wants to pay attention to how important assumptions about core concepts are in IS studies.

Thus far, we have considered known gaps in existing literature. We are also interested in unknown gaps. We assume that this literature review has produced a synthesis (framework) of the phenomenon under study. Our idea is to analyze that framework (synthesis) and consider its variables (called dimensions) and their relationships. Concerning an existing variable, we analyze its classes and try to find its nonexistent classes (case 1) in the framework (synthesis) after the literature review. If knowledge about this unknown class of a certain variable is important, then it is a candidate for a new improved framework to be tested in the next study. Similar reasoning is proposed for a potential unknown class of an existing relationship between two variables (case 2) in the framework (synthesis) after the literature review. The third case (case 3) is a missing dimension, i.e., a variable in the framework (synthesis) after the literature review. In principle, this kind of reasoning could be continued with a combination of entities, e.g., (variable 1 - relationship - variable 2).

For example, we have long had such a gender orientation that there are females and males. But recently there have also been others (homosexual, lesbian and transsexual), say variants. When we earlier classified a gender orientation to two classes, we now can do it into three or more classes.

In summary, first, we have shown that there are many methods for conducting literature reviews, and our guidelines are Levy and Ellis (2006) and Schryen (2015). Second, there are some attempts to classify different literature

reviews into a smaller number of review classes consisting of similar studies, but they are not perfect yet. Third, we can derive knowledge from literature reviews. Fourth, we can conduct gap-spotting in existing literature, and we have ideas for doing the same for "nonexistent ones" (class, relationship, dimension).

4 A SPOT-CHECK OF SELECTED NEW ARTICLES

In this chapter, eight new articles are evaluated. We consider whether the authors apply guidelines for a certain methodology in Chapter 2. In addion, eight new articles are analyzed by seeking some mistakes and deficiencies that can occur. It is also asked, how researchers perform a literature review. Writing, that is needed in every study, is well-realized. Hence, it is bypassesed.

A set of these articles is not a random sample strictly speaking, but it is practically random, because the eight articles are picked up from a stream of our group to read new articles with doctoral students; scientifically, the set is a convenient sample. The articles to be evaluated are case studies, theory-testing, conceptual studies and literature reviews. We do not have a study for physical (systems) development but we include several studies about conceptual development. To improve the reader's understanding and support the authors, we include the original abstract of the article and summarize the article before we review it. We analyze methodology and literature review of every study in our sample, corresponding to chapters 2 and 3 above. In Section 4.9, we provide a short summary.

4.1 Saunila et al. (2019)

Saunila, Ukko and Rantala examine the relationship between digital service capabilities (consumer, market and service orientations) and human factors in two case firms working with a network trade company. The authors also widen their novel research domain and mainly cite references from marketing science.

Abstract

Purpose – The purpose of this paper is to explore the different human factor characteristics that are emphasized when co-creating value through digital service capabilities.

Design/methodology/approach – Empirical data are gathered from two small companies that deliver digital services and products in business-to-business markets.

Findings – The study highlights the role and importance of human factors as reflected in employees' customer orientation while delivering digital service capabilities. The role of human factors also changes during the digital service production process.
Originality/value – Developing digital service capability is positively associated with value co-creation, but it requires new skills: firms need to evaluate their mechanisms for supporting continuous learning about the properties of digital technologies. To the authors' knowledge, this is the first study to focus on the role of human factors in developing digital service capabilities.
Keywords: Competences, Co-creation, Small and medium sized enterprises (SMEs), E-service, Services operation and management
Paper type: Research paper (Saunila et al. 2019)

On the article

Introduction

Saunila, Ukko and Rantala begin as follows:

> Digitalization has permanently altered product and service delivery, markets and customers. (Saunila et al. 2019, p. 627)

After reading this article quickly once, we felt that it definitely concerned a novel topic with new terminology. Therefore, we asked Saunila to give her definition of "digital service". She states that it means "a service enabled by digital technology and this service is offered without space and time". She observes that, for example, reservation systems and applications in network are such services. In this article, a network shop is considered from a service provider's viewpoint in connection with two small firms, Case A and Case B.

In this article, the authors write:

> Williams et al. (2010) define digital services as services that are arranged through a digital transaction over internet. Although such service may include digital elements, not all elements or interactions are required to be digital. This makes human factors a crucial aspect of providing value through digital service capabilities. (Saunila et al. 2019, p. 628)

The two definitions of digital service seem similar. Saunila et al. then state:

> Empirical data are gathered from two small case study companies that deliver digital services and products in a business-to-business (B2B) setting. In B2B setting, the customers are familiar with the service provider, and the service provider has a lot of information about their customers. Further, the service providers in this study are not one-time suppliers but strive for long-term customer relationships. The lengthy cooperation enables the partners to share private information, decrease information asymmetries and facilitate the development of trust (Poppo et al., 2008). (Saunila et al. 2019, p. 628)

Saunila et al. motivate their study and the reader as follows:

> human factors in the context of digital services are an unexplored area, especially the extent to which they influence value co-creation from a company's perspective. (Saunila et al. 2019, p. 628)

Literature review

This section contains three subsections: 1) value creation and co-creation, 2) value co-creation and digital service capabilities, and 3) human factors in value co-creation. In the second subsection, the authors state:

> To develop an understanding of the determinants of digital service capability, this study examines how a company orients its organizational activities in an attempt to develop customer value. Accordingly, digital service capabilities are divided into three categories: customer orientation, market orientation and service orientation. (Saunila et al. 2019, p. 630)

The three orientations are centrally used in this study to form the first dimension and its classes. The authors collect human factors characteristics, the second dimension, with the following classes: experience and implicit knowledge, skills and roles, and attitude and ability presented in Saunila et al. (2019, Table II, p. 633). The classes are based on literature, mainly in marketing.

Research methodology

Saunila et al. present:

> As this study aimed to gain insight about the different human factor characteristics that are emphasized in the process of co-creating value in the B2B context, the qualitative [case study] approach was employed. (Saunila et al. 2019, p. 633)

> The lack of existing theory on the different human factor characteristics emphasized when co-creating value through digital service capabilities also supported the use of this qualitative method. This study is guided by the principles of abductive reasoning, which is used to develop a theory by understanding and interpreting a phenomenon. (Saunila et al. 2019, p. 634)

Results

In this section, the authors state:

> The different human factor characteristics that are emphasized when co-creating value through digital service capabilities. The results are summarized in Table IV [Table 31]. (Saunila et al. 2019, p. 636)

Table 31 Summary of the findings on human factor characteristics (Saunila et al. 2019, p. 637)

Digital service capabilities	Experience, implicit knowledge	Skills, roles	Attitude, ability
Customer orientation	Experience of combining and synthesizing relevant aspects from multiple places Behavior toward open communication Behavior toward managing personal dynamics Face-to-face communication experience	Skills to combine and sum relevant aspects from multiple places The means to keep the customer up to date Face-to-face communication skills The means to support	Attitude toward keeping the customer up to date Building trust Attitude toward supporting customer change process

	Building trust Experience in supporting customer change process Facilitating culture of openness	customer change process	
Market orientation	Experience of finding external partners Exploring new possibilities	The means to find external partners	Keeping up with constant development Attitude toward new possibilities
Service orientation	Behavior toward understanding the customer's position Ability to understand the customer's wants	Skills to balance the customer's wants and technical feasibility	Attitude toward empathizing with the customer Listening to the customer's wants

The authors explain results from the consumer, market and service orientations' point of views.

Discussion

Saunila et al. first emphasize an importance of their results. They end this section as follows:

> In sum, this study's results contribute to the field by providing evidence that human factors facilitate value creation in a digital service environment through service orientation and customer orientation, rather than through market orientation. Further, the results indicate that although human factors play an important role in the value creation process, they have a stronger impact during the front end phase of production of digital products and services. (Saunila et al. 2019, p. 641)

Conclusion

The authors present implications of their study. Then they state that several limitations can be addressed in future research.

Review

We structure this section as follows: methodology and literature review.

Methodology

Data are gathered from two small case study companies; researchers have few opportunities to select case companies. Researchers are happy when they can have access to any company to get real data. In the section "Research methodology," the authors state that they used the qualitative case method. In Section 'Introduction' of this work, it was paid attention to a division of a goal in a study: 1) what is a part of reality (truth) and 2) what is a utility of a new system. To our mind, the qualitative case method is intended to alternative 1). The authors state that "The purpose of this paper is to explore the different human factor characteristics that are emphasized when co-creating value through digital service capabilities". The citation means that the authors want to study: Do

human factor characteristics support a value-creation? The latter is considered a utility measure and hence, Saunila et al. should use design or action science methodology, not case study.

Saunila et al. state that they found classes for digital service capabilities (customer orientation, market orientation and service orientation) and for human factors characteristics (experience and implicit knowledge, skills and roles, and attitude and ability), by using a literature review. This means that the classes were found in the literature, not from two cases. Thus, observations in the two cases cannot have any influence on the classes in the two dimensions.

The authors show interesting results, which we presented in Table 31. The authors also introduce the reader to novel important concepts.

The authors seem to include interviewing and surveying (questionnaire) as research methods, but many consider them data-gathering techniques. When a researcher is interviewing, she normally uses interview questions that are derived from the research question (but they are now lacking) and the interview questions are normally published in the article so that another researcher can review and repeat the study.

Literature review

The authors do not provide guidance for performing a literature review; where normally are

1. which are article databases (a minimum of four, Kitchenham et al. 2009),
2. which are keywords,
3. excluding and including principles, etc.

(cf. Levy and Ellis 2006, Schryen 2015).

During their literature review, the authors gathered the following human factors: experience and implicit knowledge, skills and roles, attitude and ability. They mainly use marketing literature. However, "human factors" is a subdomain in psychology. There is a distinguished journal (*Human Factors*), but the authors do not refer to it. We (researchers in IS) prefer an arrangement where we directly refer to the reference science (here, psychology) rather than indirectly (via marketing science).

Summary: Saunila et al. have many difficulties with methodology and literature review.

4.2 Bozic and Dimovski (2019)

Bozic and Dimovski prepared a research model for how the use of business intelligence and analytics (BI&A) increases a firm's performance directly and through innovation ambidexterity (balancing exploitative and explorative innovation). The use of BI&A affects innovation directly and via absorptive capacity indirectly. Data gathered from Slovenian industry support the research model.

Abstract

To survive in a dynamic and hyper-competitive business environment, firms are compelled to simultaneously introduce incremental and radical innovations. While it is recognized that business intelligence and analytics (BI&A) can support innovation and provide organizational value, the literature provides a limited understanding of its impact on balancing different innovation activities and ensuring performance gains. In this study, we examine the relationship between BI &A use, innovation ambidexterity, and firm performance by relying on the process theory of IS value creation as well as the dynamic capabilities perspective. We test our model using data collected from medium- and large-sized firms in Slovenia, applying partial least squares modeling. The results support the notion that BI&A use is positively associated with successful balancing between explorative and exploitative innovation activities, which in turn enhances firm performance. Our results also indicate that innovation ambidexterity is enhanced in two ways: indirectly through interaction with the firm's absorptive capacity, and directly by increasing the possibilities of faster experimentation with offerings of products or services and improved predictability of the value of new products or services. (Bozic and Dimovski 2019)

On the article

Introduction

Bozic and Dimovski find that:

> Firms today encounter greater competition and dynamism in the marketplace due to globalization and ongoing technological developments. Maintaining an edge over the competition requires firms to innovate in two ways at once: incrementally and radically (Lin et al., 2013). Faced with the ever growing volume of data, firms are increasingly turning to business intelligence and analytics (BI&A) for useful insights, patterns and correlations that might facilitate efficient decision-making and increase economic value (Gartner, 2016). In this sense, BI&A refer to a variety of techniques, technologies, systems and applications aimed at helping a given organization analyze diverse business and market data and information in a way that enhances its ability to make business decisions (Chen et al., 2012). (Bozic and Dimovski 2019, p. 1)

The authors motivate their study and state their research tasks as follows:

> Although many authors have found new external knowledge, from a narrow range of external sources facilitates exploitative innovation, and new external knowledge, from a broad range of external sources enhances explorative innovation (Chiang and Hung, 2010; Darroch, 2005; Jansen et al., 2006; Limaj and Bernroider, 2017), simply acquiring new information and knowledge does not intrinsically lead to innovation and improved performance (Lane et al., 2006). Instead, firms must be able to assimilate, transform and exploit this new knowledge to promote new or improved products and services (Chen et al., 2009). Along the same lines, Gao et al. (2017) and Duan et al. (2018) recently suggested that knowledge-creation abilities might underlie innovation processes due to BI&A use, and called for further consideration of this overlooked perspective. Extending this discourse, we seek to address this gap by drawing on the process theory of IT value creation and the dynamic capabilities perspective to pursue the following objectives: (i) to develop and validate a model to understand the role of BI&A use in balancing explorative and exploitative innovation activities and fostering firm performance; and (ii) to define the role of organizational absorptive capacity in the process of converting BI&A use into BI&A impacts. (Bozic and Dimovski 2019, p. 2)

Bozic and Dimovski show that their study produces the following contributions: 1) They theoretically examine relationships between BI&A use and differ-

ent innovation activities; and empirically, they specify the role of BI&A use in balancing exploitative and explorative innovation activities, and in this way to create organizational value. 2) They introduce absorptive capacity as a mediation mechanism for the BI&A use - innovation ambidexterity relationship. Overall, the authors' theoretical model and empirical results offer a holistic understanding of the relationship among BI&A use, innovation ambidexterity and firm performance.

Theoretical background and research model

This section is structured according to the variables: business intelligence and analysis use, innovation ambidexterity and absorptive capacity. The authors consider these three variables from their model and present previous results related to these variables. Bozic and Dimovski (2019) supplement the definition of BI&A as follows: "BI&A as referring to the technologies, techniques, systems, processes and applications used to acquire, store, analyze and transform business and market data and information into relevant knowledge for use in making better business decisions". They continue that BI&A relies on advanced analytic techniques, including machine learning, visualization, forecasting, text and data mining, neural networks, network analysis, and graph analysis. The authors define organizational BI&A use as a lower-order dynamic capability that organizations can leverage to create leading-edge knowledge in a dynamic environmental setting. BI&A allows "organizations to establish knowledge-creation routines as essential dynamic capabilities and to process considerable amounts of information via the information-processing capability, thus facilitating the creation of knowledge." Bozic and Dimovski (2019) consider that "path-dependent, unique and idiosyncratic processes are the crux and source of competitive advantage." The authors then build a base for their model, its main variables and their relations as follows: "Firms must embed their use of BI&A in other capabilities that are idiosyncratic to the firms, such as absorptive capacity and innovation capability." Then, the authors refer to other scholars by describing higher-order or meta-capability as a dynamic capability related to the learning-to-learn capability, which enables innovation and is self-renewing by creating lower-order capabilities.

Innovation ambidexterity means "finding a balance between exploitative and explorative innovation activities to introduce incremental and radical innovation for a superior sustainable performance." (Bozic and Dimovski 2019). The authors employ the orthogonality view that sees the two activities as independent imperatives (Gupta et al., 2006). We conceptualize innovation ambidexterity as an organizational dynamic capability which encompasses the routines and processes that ambidextrous organizations rely on to allocate, mobilize, coordinate and integrate various contradictory innovative efforts. Innovation ambidexterity has been characterized as the firm's "learning-to-learn" ability which can be managed to promote sensing and seizing of new opportunities and mitigate possible effects of path-dependence.

Cohen and Levinthal conceptualize absorptive capacity as

> the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends. (Cohen and Levinthal 1990, p. 128)

It allows firms to better evaluate stimuli from the external environment by identifying new, external knowledge for assimilation and integration with previous, internal knowledge. Bozic and Dimovski state:

> In this study, we rely on absorptive capacity as conceptualized by Zahra and George (2002) and Flatten et al. (2011), namely, as a dynamic capability that refers to knowledge creation and utilization. In this view, absorptive capacity can be divided into four underpinning capabilities: knowledge acquisition, knowledge assimilation, knowledge transformation, and knowledge exploitation. Knowledge acquisition refers to an organization's ability to identify and acquire information from external sources (Cohen and Levinthal, 1990; Zahra and George, 2002); knowledge assimilation is the ability of a firm to analyze and understand the information it acquires (Flatten et al., 2011); knowledge transformation relates to the combinative abilities and routines used to synthesize and apply the newly acquired knowledge and the existing knowledge from the prior knowledge base, and how this knowledge is internalized (Zahra and George, 2002); while knowledge exploitation is the application and utilization of the knowledge so transformed to create new products, processes and routines (Flatten et al., 2011). Together these capabilities generate synergistic outcomes that enable a firm to achieve a competitive advantage by successfully exploiting new knowledge and engaging in new product innovation. (Bozic and Dimovski 2019, p. 4)

Research model and hypotheses

Bozic and Dimovski (2019) developed

> a proposed research model presented in Fig. 1 [Figure 14] shows the hypothesized relationships between BI&A use, innovation ambidexterity, and firm performance. (Bozic and Dimovski 2019, p. 4)

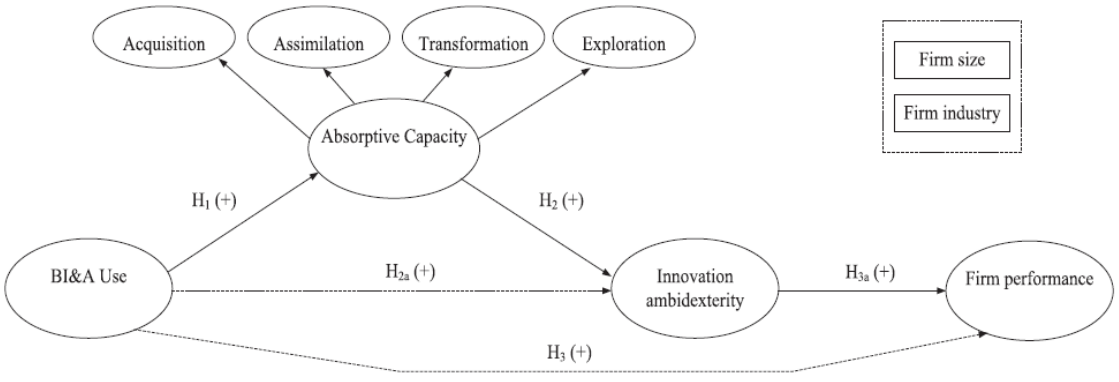

Figure 14 Proposed conceptual model. Note: The dotted lines represent the hypotheses on mediation (indirect) effects via absorptive capacity and innovation ambidexterity (Bozic and Dimovski 2019, p. 4)

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terity, and firm performance: A dynamic capabilities perspective, 1-20, Copyright (2020), with permission from Elsevier

The authors state that their model is based on an article Trieu (2017). Trieu took Soh and Markus (1995) as a basis, and IT investments convert into IT assets. IT assets are used and IT impacts perceived; the latter are related to firm's performance. Thieu (2017) then used the similar three-steps model supplemented by Melville et al. (2004) and Schreyn (2013) (Figure 15). In both models, there is the same process structure. Bozic and Dimovski

> posit that investments in BI&A are insufficient to realize value from technology; BI&A assets should instead be leveraged by BI&A use capability and integrated with other higher-order dynamic capabilities (absorptive capacity for knowledge creation and innovation ambidexterity) to generate organizational performance gains. Accordingly, we developed our hypotheses to explain the ways in which BI&A use is converted into BI&A impacts and organizational performance, (Bozic and Dimovski 2019, p. 4)

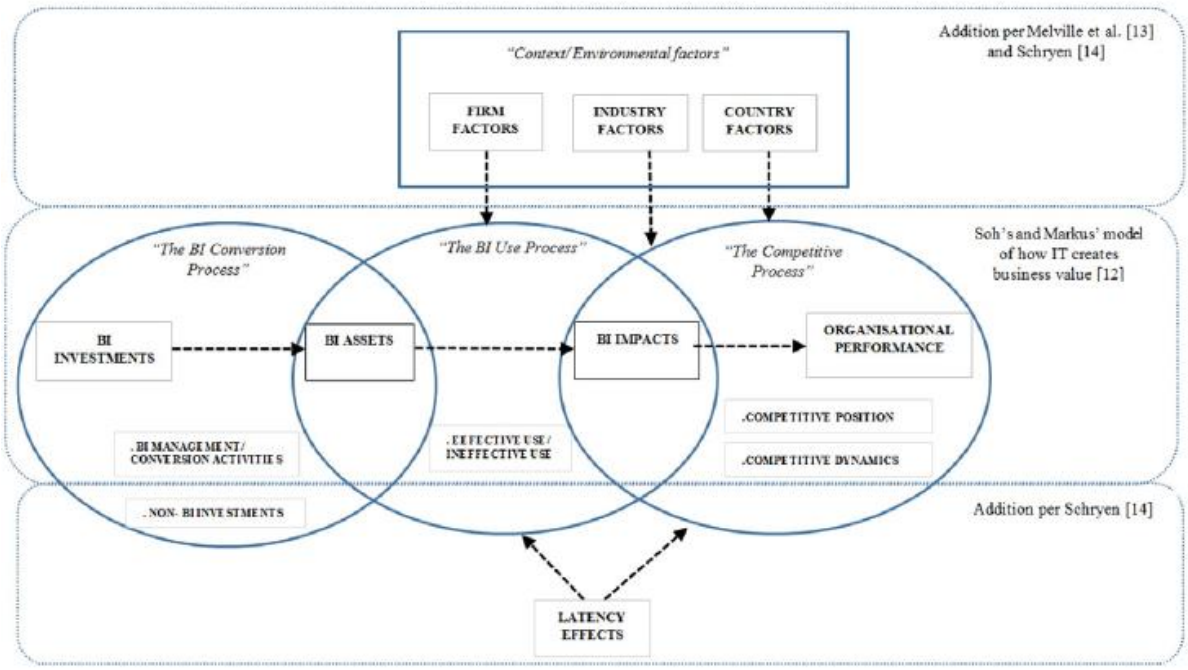

Figure 15 A framework of how BI creates business value (adapted from Soh and Markus (1995), Melville et al. (2004), Schryen (2013) (Trieu 2017, p. 113)

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Bozic and Dimovski then describe several hypotheses. They consider that:

> Lower information processing costs allow BI&A to assume the role of active gatekeeper integrating insights and intelligence from a variety of sources for more holistic market intelligence (Altman et al., 2014; Fan et al., 2015). Thus, BI&A enable firms

> to facilitate the acquisition, storage and exchange of knowledge, as well as to integrate and store fragmented knowledge about the business environment and competition (Chuang, 2004; Gold et al., 2001; Lee and Choi, 2003). The processes of external knowledge acquisition and assimilation allow the firm to track market changes more effectively, further supporting the development and deployment of needed capabilities (Zahra and George, 2002). (Bozic and Dimovski 2019, p. 5)

Therefore, they propose:

H1 BI&A use positively relates to a firm's absorptive capacity for knowledge creation.

The authors state:

> As some earlier literature suggests, absorptive capacity and innovative ambidexterity are closely related organizational dynamic variables that firms must integrate and reconfigure to achieve congruence with the constantly changing environment (O'Reilly and Tushman, 2008; Rosenkopf and Nerkar, 2001; Teece, 2007) in order to sustain a competitive advantage (Lane et al., 2006; Zahra and George, 2002). Absorptive capacity supported by BI&A allows real-time information and improved cross-functional communication among the individuals included in the process, building intuition about the changing marketplace that then allows for faster organizational adaptation (cf., Eisenhardt and Martin, 2000; O'Reilly and Tushman, 2008). (Bozic and Dimovski 2019, p. 5)

Bozic and Dimovski then present two hypotheses:

H2 A firm's absorptive capacity for knowledge creation positively relates to its innovation ambidexterity.

H2a The absorptive capacity for knowledge creation positively mediates the relationship between BI&A use and innovation ambidexterity.

Bozic and Dimkovski see that:

> Process theory posits that organizations can achieve improved organizational performance through the conversion process of the creation of an "intermediate outcome" such as new products or development of new services (Soh and Markus, 1995; Trieu, 2017). Firms can only expect an increased performance when BI&A use is deployed to create unique complementarities with other dynamic capabilities, such as through the support of innovation abilities (Duan and Cao, 2015; Foss et al., 2011; Lavalle et al., 2011; Ravichandran and Lertwongsatien, 2005; Wamba et al., 2017). (Bozic and Dimovski 2019, p. 6)

Therefore, they propose the following hypothesis:

H3 A firm's innovation ambidexterity mediates the relationship between the firm's BI&A use and firm performance.

The authors conclude:

> Despite the controversy found in the literature, the prevailing research evidence suggests there is a positive association between innovation and firm performance. (Bozic and Dimovski 2019, p. 6)

They posit:

H3a A firm's innovation ambidexterity positively relates to firm performance.

Research methodology

Bozic and Dimovski tested their research model by performing a survey. The instrument relied on a comprehensive literature review in which all constructs were operationalized by validated measurement scales found in the literature. The contents of the scales were validated by experts. The authors selected 500 persons from the 101 most successful Slovenian firms. The respondents' addresses were taken from two public sources. The number of responses was 97. Bozic and Dimovski counted many tests about their data material and described the sample demographics.

In the subsection "Structural equation modeling approach," the authors state that they:

> relied on variance-based partial least squares (PLS-SEM) to estimate the structural equation model (Chin, 1998; Hair et al., 2017a; Lohmoller, 1988). PLS-SEM is especially useful when a model includes second-order variables and complex mediation relationships (Hair et al., 2012; Ringle et al., 2012). Moreover, PLS-SEM has proven useful while analyzing relatively small sample sizes in medium- and high-complexity model setups (Reinartz et al., 2009). (Bozic and Dimovski 2019, p. 7)

In the subsection "Measurement and validation of the constructs," Bozic and Dimovski analyze independent, dependent and control variables. The independent variables are BI&A use and absorption capacity. The authors measured the BI&A use variable with 10 items. Instead of BI&A use, they use a proxy variable for the benefits of its use, and the values of each item can range from 1 to 7.

They measured a firm's absorptive capacity with a measurement scale already developed and tested. Four components (knowledge acquisition, assimilation, transformation, and exploitation) were taken into account then. The response scale ranged from 1 ("*strongly disagree*") to 7 ("*strongly agree*").

There are two dependent variables, innovation ambidexterity and firm performance. For the former, Bozic and Dimovski used two six-item scales from Jansen et al. (2006) for exploitative and explorative innovation, respectively. The authors then ran four regression analyses with performance as the dependent variable. They used the F-test to examine models.

According to the authors, many research studies have analyzed the impact of innovation ambidexterity on firm performance and results differ because of different measures. They presented: return on investment, average profitability, return on sales, return on assets or a combination of revenues, profits and market growth. Therefore, Bozic and Dimovski include more than one criterion and measured 3 years (instead of 1 year) and a 5-point Likert scale.

Results

Bozic and Dimovski first consider that all their variables were measured with scales and are reflective. This also concerns the components of the absorptive capacity (acquisition, assimilation, transformation, and exploitation) correctly measured. Thus, their measurement model seems to be acceptable.

For reflective measurement, the authors checked that such control measures as reliability, convergent and discriminant validity were correct. For the structural model, many checks are available. Bozic and Dimovski state the following:

> To evaluate the structural model, we provided a collinearity assessment, the squared multiple correlations R2, structural path coefficients, the predictive relevance of endogenous variables using Stone Geisser's Q2 values, effect size values f2, and the effect size values q2 as recommended by Hair et al. (2017a). (Bozic and Dimovski 2019, p. 9)

The authors describe the (non-mediation) results positively:

> The results show that the conceptual model explains 55.5% of the variation in innovation ambidexterity and 20.5% of the variation in firm performance. Hence, BI&A use is statistically significant in explaining absorptive capacity (β=0.598, $p < .01$) and absorptive capacity is statistically significant in explaining innovation ambidexterity (β=0.616, $p < .01$). Hypotheses H1 and H2 are thus supported. Moreover, the results indicate innovation ambidexterity is significantly and positively related to firm performance, supporting hypothesis H3. However, we did not find a significant influence of the control variables such as industry type (industrial vs. service) and firm size on firm performance. (Bozic and Dimovski 2019, p. 9)

Bozic and Dimovski state two mediation hypotheses: Absorptive capacity mediates the relationship between BI&A use and innovation ambidexterity, and innovation ambidexterity mediates between BI&A use and firm performance. H2a and H3 received support.

Discussion and conclusion

The authors state generally:

> Existing research gives anecdotal, conceptual and empirical evidence to back up the strong assertions made about the ability of BI&A to enhance firms' innovation ability and firm performance (Lavalle et al., 2011; Stubbs, 2014). This study aimed to further understand the mechanisms by which BI&A contributes to innovation ambidexterity and firm performance from a use perspective. Based on prior research on innovation, we proposed and tested a research model that integrated the domains of dynamic capabilities, knowledge management, and information processing. The key findings suggest that BI&A use is positively associated with the ability to balance competing innovation activities, which in turn enhances the firm's performance. This association was mainly explained through the firm's absorptive capacity, which enables firms to leverage external information and their knowledge-supporting innovation ability. (Bozic and Dimovski 2019, p. 10)

Bozic and Dimovski divide the Discussion section into three parts: theoretical contributions, practical implications, and limitations and future research.

In the subsection "Theoretical contributions," the authors conclude that the study offers several theoretical contributions to BI&A and IS literature. They mention only a few:

> Our research suggests that BI&A use enhances innovation ambidexterity mainly through the knowledge-harnessing that is enabled by organizational absorptive capacity. (Bozic and Dimovski 2019, p. 10)

and

> We also found a significant direct association between BI&A use and innovation ambidexterity. (Bozic and Dimovski 2019, p. 11)

In the subsection "Practical implications," Bozic and Dimovski state:

> Our study has important practical implications for managers who are engaged in BI&A implementation. (Bozic and Dimovski 2019, p. 11)

For example,

> Our study findings suggest that BI&A can be leveraged as a source of improved competitive advantage by supporting exploitative and exploratory innovation abilities. Firms need to proactively employ the knowledge gained from BI&A to both improve existing products and services and to develop new products and services that fundamentally depart from existing ones. (Bozic and Dimovski 2019, p. 11)

In the subsection "Limitations and future research," the authors describe common method bias (Burton-Jones 2009) and then data gathering at a single point of time. They convert the limitations into ideas for future research and present several others.

Review

Methodology

Soh and Markus (1995) identify a process as a model with three phases: 1) IT investments are converted into IT assets. 2) IT assets are then used, and 3) the IT impacts perceived. Thieu (2017) then used the similar three steps model supplemented by Melville et al. (2004) and Schreyn (2013) (Figure 15). In both models, there is the same process structure. Bozic and Dimovski

> posit that investments in BI&A are insufficient to realize value from technology; BI&A assets should instead be leveraged by BI&A use capability and integrated with other higher-order dynamic capabilities (absorptive capacity for knowledge creation and innovation ambidexterity) to generate organizational performance gains. (Bozic and Dimovski 2019, p. 4)

(see Figure 15). Firms' use of BI&A can enhance their innovation ability and firm performance. Relationships between BI&A use and innovation ambidexterity and between BI&A use and organizational performance are mediated.

However, we think the following:

First, we could not find any competition among potential models that could be thought to be the basis.
Secondly, Trieu's (2017, Figure 2) model is technically (IT) dominant, but Bozic and Dimovski's model (Figure 15) may be socially dominant, because dynamic capabilities are based on human abilities (cf. Andreu and Ciborra 1996, Teece et al. 2016).

Thirdly, Bozic and Dimovski's model (Figure 15) seems to cover a one step process (the middle one). Only Soh and Markus' (1995) model has three steps (IT expenditure → IT assets → IT impacts → Organizational performance). Trieu (2017), Melville et al. (2004) and Schryen (2013) do not change the basic process idea.

Bozic and Dimovski develop a structural model (Figure 15) and show how firms' BI&A use can enhance their innovation ability and firm performance. Empirical data from Slovenian industry supported the model.

The authors state:

> all constructs were operationalized by validated measurement scales found in the literature. (Bozic and Dimovski 2019, p. 6)

Every scale is a Likert-type with 5, 6 or 7 possibilities per item ranging from 1 ("*strongly agree* ") to 7 ("*strongly disagree*"). This type of measuring refers to ordinal variables, and they are not suitable for structural equation modeling which demands interval variables. Moreover, MacKenzie et al. (2011) set such high requirements for validation of a scale that we cannot trust the assertion that the scales are correctly validated as the authors said.

Straub et al. (1994) developed four standards (I. Conceptual Significance, II. Practical Significance, III. Conduct of Research and IV. Presentation of Research) for positivist research other than case studies by using factor analysis. These guidelines are not used. Straub et al. (2004) supplement the previous article by developing 12 validity criteria. Bozic and Dimovski do not refer to Straub et al. (2004), but they test most of these criteria.

Literature review

The section "Theoretical background and research model" is structured according to the variables: business intelligence and analysis use, innovation ambidexterity and absorptive capacity. The authors consider how these three variables were investigated in the literature. No guidance for an approach to a literature review is mentioned, we recommend using either Levy and Ellis (2006) or Schryen (2015).

4.3 Pasmore et al. (2019)

This article seems to be a report for the future. The authors write almost as business consultants (everything changes, all the technical advancements can and must be taken into account, etc.). According to Pasmore et al. (2019), the definition of socio-technical design must be moved to the present without worrying about whether other researchers accept the new interpretation.

Abstract

This paper traces the evolution of socio-technical systems design from its origins in the coal mines of Great Britain to the present day and beyond, into our digital future. Conceived as a means of enhancing productivity while simultaneously providing more meaningful work, socio-technical thinking gained ground in machine-driven work settings and later took a leap forward to aid the effectiveness of knowledge work. After a period of stagnation as popular fads such as total quality, reengineering and lean six sigma took hold, socio-technical thinking is poised to reemerge as capabilities associated with new technologies are rapidly outpacing the development of new organizational designs. A recent socio-technical systems design lab brought together a diverse group of academics, thinkers and practitioners to discuss the future of organization design, producing tantalizing insights into the world that is about to take shape. Finally, implications for change management in socio-technical transformation are discussed. (Pasmore et al. 2019)

On the article

This article consists of the following chapters or parts: The past, The present: social and technical disruption, The future: 'Next-Gen' socio-technical systems insights from the STARLab, STS (Socio-technical systems) design for the future, Implications for STS change management and Conclusions.

The past

The authors briefly describe a history of STS. They then summarize principles of STS by referring to Cherns (1976), see Table 32.

Table 32 Classic socio-technical system design principles (Pasmore et al. 2019, p. 69)

Principle	Explanation
Wholeness	The work system should be conceived as a set of activities making up a functioning whole, rather than a collection of individual jobs.
Teams	The work group should be considered more central than individual jobholders.
Process control	Variances (problems or deviations from expectations) should be identified and handled as close to their point of origin as possible, preferably by those who can prevent them from occurring, without requiring supervisory intervention
Self-direction	Internal regulation of the work system is preferable to external regulation of individuals by supervisors.
Multi-skilling	The underlying design philosophy should be based on a redundancy of functions rather than on a redundancy of parts (multiskilling vs. single-skilling).
Discretion	The discretionary component of work is as important to the success of the system as the prescribed component.
Joint-optimization	The individual should be viewed as complementary to the machine rather than as an extension of it.
Adaptation	The design of work should be variety increasing rather than variety decreasing, meaning that individual and organizational learning is essential to allow organizational adaptation to change.
Meaning	At the level of the individual job in a socio-technical system, there should be for each person an optimal level of variety, learning opportunities, some scope for setting decisions that affect the outcomes of work, organi-

Incompletion	zational support, a job worthy of societal recognition, and the potential for a desirable future. Since the context of the organization will continue to evolve over time, no design can be considered 'finished.'

The present: social and technical disruption

Pasmore et al. presents different paths for the social and technical development (see also Figure 16).

The future: "Next-Gen" socio-technical systems insights from the STARLab

Pasmore et al. (2019) describe that technology has advanced considerably, but people have not. Therefore, there is a need to bring the social side of STS up to date (Figure 16).

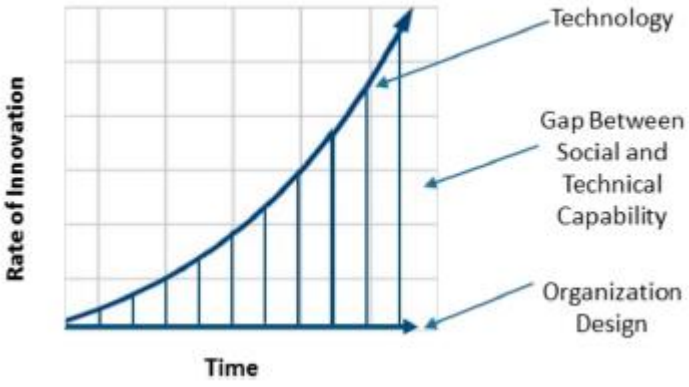

Figure 16 The increasing gap between technical and social capability caused by the lack of innovation in organizational design innovation compared to the exponential advancement of technology (Pasmore et al. 2019, p. 73)

The authors organized a research laboratory

> in September, 2017, to an assemblage of thirty invited academics, executives, futurists, technology professionals, ethicists, social scientists and change practitioners in a two-day socio-technical action research lab (STARLab). It was convened to answer two broad questions:
> *In order to purposefully align the social and technical elements of how organizations are evolving and to arrive at organizational futures based on both reflection and invention*: *How will the technologically enabled organizations of the future function and what are the implications for their design and leadership*?
> *What are the attributes of the change processes that can get us there*? (Pasmore et al. 2019, p. 73)

STS design for the future

The authors present

> some differences between classic socio-technical systems design and what we will likely see in the future. (Pasmore et al. 2019, p. 79)

(cf. Table 33).

Table 33 Shifts in socio-technical systems design we expect to see in the future (Pasmore et al. 2019, p. 79)

From	To
Designing an organization	Designing an organization and its ecosystem
Designing a static system	Designing a system that is in a continuous state of change
Designing social systems around a fixed technical system to achieve joint optimization	Designing organizations, ecosystems, technical systems and social systems on an ongoing basis as each element changes to achieve balanced optimization
Using an internal design team to represent the system being designed	Using design labs that bring many voices from inside and outside the system into the design process
Designing the work system	Designing the strategic, operating and work systems
Designing a system with a fixed membership for its current members	Designing a system in which many important contributions are made by people who come and go as their expertise is needed; designing for people who are not yet members of the system
Focusing exclusively on the internal workings of the system	Perfecting collaborative work among entities that compose the value chain
Designing for high performance and variance control	Designing for innovation and agility
Design based on analysis of current systems	Design based on ideas about what is possible

Implications for socio-technical systems change management

The authors ask

> Given the glimpse into the future provided by participants in the STAR Lab, what are the implications for STS change management? First, our historical approach to STS change management can be traced back to Lewin's idea that change involves unfreezing, change and refreezing. (Pasmore et al. 2019, p. 80)

Some of these changes are shown in Table 34.

Table 34 Shifts in STS change management we expect to see in the future (Pasmore et al. 2019, p. 82)

From	To
Project -based	Continuous
Focus and involvement is primarily internal	Focus is both internal and on the ecosystem; using a 'whole systems' approach that includes representatives of the ecosystem as well as relevant experts providing knowledge input
Multiple disconnected change efforts not prioritized and competing for resources	Governance system provides strategic direction, alignment and prioritization

Linear, driven by budget and timeline	Iterative prototyping, adaptive, driven by data and learning
Fixed organizational structure and associated territoriality constrain change opportunities	Agile structure more readily permits redeployment of resources and opens up creative potential
Change led by experts working with people in power; top-down	Change leadership is inclusive and varies depending on experience and expertise needed; top-down, bottom-up, inside-out and outside-in
Spreading change slowly relying on traditional training and communication methods	Taking advantage of new technologies to permit blitz-scaling

Conclusions

Pasmore et al. conclude: "From our vantage point, there has never been a greater need to insure that the needs of human beings and social systems are respected and brought into balance with the advantages that technology offers".

Review

Methodology

This article has a conceptual part and an empirical part. Pasmore et al. state:

> Developed by Spring Network, a Silicon Valley-based organization design firm, the STARLab is a rapid organization design approach that involves a multi-stakeholder group working iteratively to create design solutions to address the changing realities of the business context and to generate socio-technically optimized organization prototypes. (Pasmore et al. 2019, p. 73)

The authors describe the past and the present of socio-technical design, and then the lab and its outputs for illuminating the future of work systems and provide a path for how a new change can be undertaken.

The authors (Pasmore et al. 2019, p. 69) state that they referred to (Cherns, 1976) when they collected their 10 principles of socio-technical design (Table 32). Mumford (2006, p. 22) also refers to the same article and present nine principles that clearly differ from Pasmore et al.'s. We repeat Mumford's list of nine principles taken from Cherns (1976) (cf. Mumford 2006, p. 322):

Principle 1. **Compatibility**. Process of design must be compatible with its objectives. This means that if the aim is to create democratic work structures then democratic processes must be used to create these.

Principle 2. **Minimal Critical Specification**. No more should be specified than is absolutely essential. But the essential must be specified. This is often interpreted as giving employee groups clear objectives but leaving them to decide how to achieve these.

Principle 3. **The Socio-technical Criterion**. Variances, defined as deviations from expected norms and standards, if they cannot be eliminated, must be controlled as close to their point of origin as possible. Prob-

lems of this kind should be solved by the group that experiences them and not by another group such as a supervisory group.

Principle 4. **The Multifunctionality Principle**. Work needs a redundancy of functions for adaptability and learning. For groups to be flexible and able to respond to change, they need a variety of skills. These will be more than their day-to-day activities require.

Principle 5. **Boundary location**. Boundaries should facilitate the sharing of knowledge and experience. They should occur where there is a natural discontinuity – time, technology change, etc. – in the work process. Boundaries occur where work activities pass from one group to another and a new set of activities or skills is required. All groups should learn from each other despite the existence of the boundary.

Principle 6. **Information** must go, in the first instance, to the place where it is needed for action. In bureaucratically run companies, information about efficiency at lower levels is collected and given to management. It is preferable for it to go first to the work group whose efficiency is being monitored.

Principle 7. **Support Congruence**. Systems of social support must be designed to reinforce the desired social behavior. If employees are expected to cooperate with each other, management must also show cooperative behavior.

Principle 8. **Design and Human Values**. High quality work requires: ⋅ jobs to be reasonably demanding; ⋅ opportunity to learn; an area of decision-making; ⋅ social support; ⋅ the opportunity to relate work to social life; and ⋅ a job that leads to a desirable future.

Principle 9. **Incompletion**. The recognition that design is an iterative process. Design never stops. New demands and conditions in the work environment mean that continual rethinking of structures and objectives is required.

We recognize that a) Pasmore et al. (2019) found 10 but Mumford (2006) only 9 principles, b) We also recognize that only three principles are the same (multiskilling vs. multifunctionality, meaning vs. design and human values and incompletion vs. incompletion) and the other principles differ considerably. When the difference above is checked against Cherns (1976), Mumford's nine principles are almost the same as those in Cherns (1976). This fact casts a shadow over Pasmore et al.'s article.

Mumford writes (2006, p. 316) that the socio-technical approach "will be difficult to use successfully if parties involved are hostile to each other, disinterested in developing strategy and unwilling or unable to cooperate". This clearly shows that Mumford prefers consensus, not dissensus (Deetz 1996).

The authors write (p. 81) that

> STS change management must be continuous, not episodic. (Pasmore et al. 2019, p. 81)

However, in Table 33 they state that

> Using design labs that bring many voices from inside and outside the system into the design process. (Pasmore et al. 2019, p. 79)

Using a design lab cannot be continuous, because it might require much preparation, discussion or elaboration and finish (turn down), and thus, may need some organization.

Literature review

In the article, there is no literature review. There is the first section "The past" where Pasmore et al. state:

> Socio-technical systems thinking had its origins in the coal mining industry in Great Britain in the 1950s. Eric Trist and his colleague at the Tavistock Institute for Human Relations were interested in founding a social science research organization that would apply Lewin's 'action research' (Lewin, 1946) to address organizational issues and opportunities. (Pasmore et al. 2019, p. 69)

They continue (p. 69):

> Over the years, others added to the principles of socio-technical design (Cherns, 1976; Emery, 1959; Pasmore, 1988), summarized in Table 1 [Table 32] below. (Pasmore et al. 2019, p. 69)

In the subsection "Methodology" above, we discuss differences between Table 32 and the reference, Cherns (1976). Moreover, we do not see a structured literature review (e.g., Levy and Ellis 2006, Schryen 2015).

4.4 Swanson (2019)

According to Swanson, the view of technology as routine capability serving human practices that we seek to advance suggests that we must raise our research sights to new levels, if we are to grasp the "tsunami" of technology now sweeping over us. In the present paper, we have sought to reframe our view of technology and point the way ahead with this insight uppermost in mind. (Swanson 2019, p. 1022)

Abstract

> While technology is most commonly associated with material things, tools, or artifacts, it is also associated as a concept with routines, patterns of action that provide capabilities. Researchers have struggled to bring these interpretations together. Drawing from Schatzki's practice theory, we offer an overarching perspective that ties tools as devices to routines in a broader social context, yielding insights into what is termed **technology as routine capability** in the advancement of practices.

> How change in technology occurs both within and among practices is examined from this perspective. Four principal **modes of change** are identified: (1) **design**, in creating new devices and routines; (2) **execution**, in operating devices and performing routines; (3) **diffusion**, in spreading devices and routines to a population's members; and (4) **shift**, in adapting devices and routines to change among a world's practices. Change is seen to be closely intertwined among the modes, suggesting that future research examine cross-modal change, in particular, to gain a better understanding of how new technology advances practices. Overall, our new perspective provides a lens that ties together previous strands of research, allowing insights from multiple studies to accumulate in a way that both illuminates and motivates further work. Enlarging on current interpretations, it suggests that routines are integral to technology itself. (Swanson 2019)

On the article

Introduction

The author motivates the reader:

> Here we do reflect and suggest a refinement in how we think about new technology, arguing that a fruitful understanding hinges on our corresponding grasp of tools and routines, and, in particular, their relationship to each other. We explore this relationship in the context of modern information technology (IT), motivated by the now commonplace observation that our world is increasingly saturated with technologies, more digital than traditionally physical, many of great consequence for the transformation of practices across industries and professions (see Yoo 2013). (Swanson 2019, p. 1007)

Technology as Device and as in Use

Swanson relates his routine capability view to three previous views:

> Table 1 [Table 35] summarizes and previews where we are going, showing how we build from basic alternative views of technology in terms of five concepts central to our own view. (Swanson 2019, p. 1009)

Table 35 Five central concepts in alternative views of technology (Swanson 2019, p. 1010)

Central Concepts	**Basic Engineering View**	**Basic Practice View**	**Basic Routine View**	**Routine Capability View**
Devices	Technology as device	Technology as device	Technology as device	Device as routine component
Affordances	Device property	Not featured	Built in routine performance	Built in routine performance
Routines	Not featured	Not featured	Routine as pattern of action	Routine as practice component
Capabilities	Not featured	Not featured	Not featured	Technology as routine capability built in practice
Practices	Not featured	Technology in use as sociomaterial assemblage	Not featured	Practices as constituted from routines and capabilities

Note: The routine capability view features five central concepts featured or not in three alternative views (plus the concept of worlds, not shown). Where a concept is not featured, this does not imply that it is altogether absent, as it may be latent and sometimes surfaced. The present portrayal shows only how the routine capability view draws from and extends the alternatives to facilitate the understanding of broad change in technologies and practices.

Routine Capability

The author introduces

> the expanded notion of technology as *routine capability*, by which we simply mean the capability associated with device-enabled routines. Usually this entails the accomplishment of some *task*. That routines provide for such capabilities is well established in the literature, though often without much elaboration. (Swanson 2019, p. 1009)

In the subsection "Human Practices," Swanson states:

> Routines also have their purposes. These may go unseen within the opened black box of the singular routine. How the task served by the routine fits into a larger scheme of human activity may go unaddressed in the basic routine view. Here, consistent with new research examining relationships among routines, we seek to remedy this. We establish a bridge between the capabilities and practice perspectives. We borrow from the traditional association of capabilities with firms and associate them instead with practices. We argue that a technology, as a routine capability, serves to advance a human practice. The concept of human practice is given a broad interpretation and understood to entail a family of routines executed in coordination, and, to some extent, socially in common. An organizational example is university administration, with its recent attempts to apply IT to faculty hiring, and promotion and tenure routines currently mired in paperwork. Human practices also include those by individuals, for example, consumers, in collective contexts such as shopping, where multiple routines are typically called upon and coordinated as needed. (Swanson 2019, p. 1011)

In the subsection "An Overarching Perspective," the author summarizes

> by means of an overarching perspective in which technology as routine capability finds its place. We will say that technology manifests itself in four constitutive and contextual spheres—those of worlds, practices, routines, and devices—as portrayed in Figure 1 [Figure 17], in which the nesting of the spheres indicates the relatedness. Note that the various worlds in which we live and work are shown as substantially constituted from our human practices and as providing the context for their advancement. Practices are shown as constituted largely from families of routines that provide capabilities. Routines are themselves purposed and developed in this context. (Swanson 2019, p. 1012)

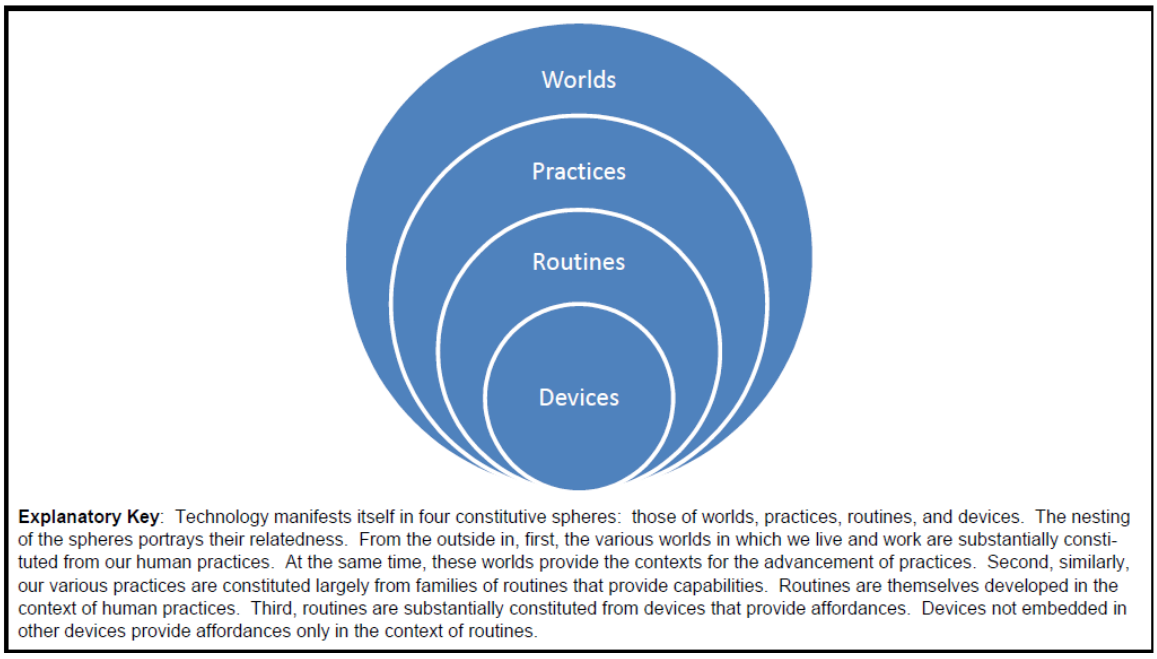

Figure 17 Four spheres of technology (Swanson 2019, p. 1013)

The author continues:

> It will be helpful to examine the four spheres of technology in the case of ERP (see Pollock and Williams 2009; Shanks et al. 2003). Following the explanatory key of Figure 1 [Figure 17], we note first the world in which ERP originated in the 1990s, that of manufacturing, constituted from practices including manufacturing engineering, plant management, operations management, quality assurance, purchasing, human resource management, and accounting, all characterized by advancements in routine capabilities since their origins. (Swanson 2019, p. 1012)

What Changes Technology as Routine Capability

Swanson states:

> Following Schatzki, we argue that technology develops largely as means to advance human practices. This provides for a rather different interpretation than offered by Arthur, who ties technological change to economic development. Through a practice perspective that brings routines to the foreground, we can address social change both within the economic system and elsewhere.
>
> We address change in technology as routine capability by considering four principal modes of change in advancing practices: (1) design, in creating new devices and routines; (2) execution, in operating devices and performing routines; (3) diffusion, in spreading devices and routines to a population's members; and (4) shift, in adapting devices and routines to change among a world's practices. We show that these modes of change play out rather differently for devices and routines, with ramifications for their fusion in achieving new capabilities. (Swanson 2019, p. 1014)

The subsection "Change by Design" seems to mainly consider a traditional systems engineering. However, Swanson states that:

> Much change in technology as routine capability occurs by design, through creative activities inspired by ideas as to how to advance a practice, applied not only to devices, but directly to routines themselves. (Swanson 2019, p. 1014)

In the subsection "Change by Execution," changes are stated to take place in the use of devices. Concerning routines, Swanson writes:

> More broadly, then, in the advancement of practices, routine capabilities are necessarily built over time through repeated local routine execution. A technology that entails demonstrable "know how" cannot be delivered by design or by new devices alone. The necessary learning requires doing, here termed execution, as has long been recognized (Arrow 1962; Levitt and March 1988; Nelson and Winter 1982). Importantly, this learning through repeated execution is not itself as routine as the term commonly suggests. (Swanson 2019, p. 1015)

The subsection "Change by Diffusion" is dominated by Rogers' diffusion idea. Swanson states (p. 1016):

> Advancing a practice entails much more than building routine capabilities through repeated local performances, however. Eventually, for the practice as a whole, the learning must be global to the population, accomplished through change by diffusion (Rogers 1995). Sometimes viewed as a form of social contagion, the diffusion of technology is seen more closely to engage a highly purposeful set of activities, as in technology transfer, in economic development, where it is well understood that the knowledge needed to produce and use some new device cannot be "moved" as can the device itself (Bozeman 2000). In our terms, such knowledge as capability is inherently local to practices and the execution of routines that constitute them. Which is not to say that it cannot with effort be substantially replicated elsewhere. (Swanson 2019, p. 1016)

Swanson ends his consideration of changes in the subsection "Change by Shift" as follows:

> Changed practices are not permanent, however. Following Schatzki, the large variety of human practices and their associated routine capabilities coexist in an ecology of sorts, in which they both cohere and compete with each other for our time and efforts. As is well known, not all practices persist endlessly or with the same frequency or intensity, or even in the same locations. While new ones originate and flourish, as with financial engineering, web design, and blogging, for instance, others wither and recede, as with stenography and professional typing, or morph into something else, as with typesetting and bookkeeping, or fall away altogether, as with telephone switchboard operation. So too do associated routines and capabilities, as performances increase, or diminish, or even cease. All this also takes place at varying paces around the world. We refer to this process of practice ebbs and flows, contractions and expansions, and the emergence and development of new practice mixes, as change by shift. (Swanson 2019, p. 1017)

Swanson summarizes

> this section's discussion in Table 2 [Table 36], which compares forms of practice change across the four modes of design, execution, diffusion, and shift. It is seen that forms differ for devices and routines, even as they join together to provide new routine capabilities. As we have also emphasized, from a routines capability perspective, neither devices nor routines comes necessarily before the other. Learning is necessary across the four modes for both devices and routines. (Swanson 2019, p. 1019)

Table 36 Technology change in practices, devices and routines (Swanson 2019, p. 1019)

Practice Change Mode	**Devices**	**Routines**
Design Advance a practice by developing devices and routines to achieve new capabilities	Build and test Example: develop new enterprise software requiring new organizational routines	Compose and instruct Example: develop new organizational routines for using new enterprise software
Execution Advance a practice by building new capabilities in carrying it out	Operate and maintain Example: provide fixes and new functionality to enterprise software as necessitated or requested in its use	Perform and improvise Example: discover new enterprise software affordances in its use, or work around the lack of such affordances
Diffusion Advance a practice by diffusing new capabilities to new adopters as best practice	Distribute and extend Example: market enterprise software to additional adopters and provide new versions to meet their needs	Replicate and normalize Example: employ consultancies to help implement purchased enterprise software following best practices
Shift Advance a practice by adapting capabilities to shifts among other practices	Redomain and reinvent Example: reconceive and redevelop enterprise software as a service and offer it in the cloud	Adapt and recreate Example: develop new support routines for using enterprise software provided as a service

Explanatory Note: Technology change in advancing practices occurs through four interacting change modes: design, execution, diffusion and shift. Change by each mode takes distinctive forms for devices and routines with implications for their fusion in achieving new capabilities. Change by one mode in advancing a practice is often associated with a related concurrent change by another. Change in worlds (not shown) is achieved through changes in practices.

Discussion

The author summarizes that:

> Extending Parmigiani's and Howard-Grenville's pointed comparison of the two traditional perspectives, our own perspective on technology as routine capability provides a fresh view of routines as shown in Table 3 [Table 37], with interest centered on how routines fuse with devices in practices. As can be seen, the focus on practices as constituted from routines enables the pursuit of important research questions that simply do not fall within the scope of traditional perspectives. In particular, the behavioral assumption that humans seek to advance their practices serves to motivate studies that would examine how all this works out with new technologies in a changing world in which any practice both coheres and competes with others. (Swanson 2019, p. 1020)

Table 37 Perspectives on routines: Extending Parmigiani and Howard-Grenville (2011) (Swanson 2019, p. 1021)

	Traditional capabilities perspective	**Traditional practice perspective**	**Technology as routine capability perspective**
Main interest	What routines do and how they lead to firm performance	How routines operate, internal dynamics	How routines fuse with devices in practices
Focal level of analysis	Firms	Routine itself	Practices as constituted from routines
Unit of analysis	Routines as "entitles" (whole routines)	Routines as "parts" (internal structure)	Routines as "wholes" and "parts" in practices
Research attention	• Firm-specificity of routines • How routines create value and lead to differential performance • How routines build to form capabilities • Complementarities between routines • Transferability within and between firms	• Actors' influence on routine performance • Artifacts' influence on routine performance • How routines change and remain stable over time • How routines are created or changed • When and how routines break down	• How new devices lead to new routines and vice versa • How new devices fuse with new routines • How routine capabilities develop and diffuse • How practices are advanced by routine capabilities • How practices grow and contract with new technologies
Behavioral assumptions	• Bounded rationality • Organization-specific foresight • Potential self-interest • Agents act as expected	• Human action is effortful • Everyday activity constitutes social life • Agents are not replaceable	• Humans seek to advance their practices
Stability and change	• Acknowledge change, but more interested in stability	• Change and stability always possible • Same mechanisms underlie change or stability	• Change is ongoing and stability is a temporary phenomenon

Review

Methodology

Hirschheim (2008) structures guidelines for conceptual research in seven areas:

> (A) introduction, (B) content, (C) presentation and structure, (D) theoretic foundation, (E) data analysis/interpretation/argumentation, (F) results, and (G) conclusions. Many of these guidelines are general and relate to any type of paper being re-

> viewed. Others – especially sections (D), (E) and (F) – are focused more on conceptual papers. (Hirschheim 2008, p. 436)

We concentrate on (D), (E) and (F) in reviewing Swanson (2019).

(D) theoretic foundations

The metaphor that helped us to understand this article, was Swanson's sentence:

> Devices must, in effect, be "wrapped" in routines in the constitution of technology. (Swanson 2019, p. 1008)

Another essential idea in Swanson's article "Technology as Routine Capability" is presented in the section "What Changes Technology as Routine Capability". Swanson states:

> Following Schatzki [his practice theory], we argue that technology develops largely as means to advance human practices. (Swanson 2019, p. 1014)

Swanson addresses

> change in technology as routine capability by considering four principal modes of change in advancing practices: (1) design, in creating new devices and routines; (2) execution, in operating devices and performing routines; (3) diffusion, in spreading devices and routines to a population's members; and (4) shift, in adapting devices and routines to change among a world's practices.

Swanson uses those four modes and demonstrates how technology advances and innovation spreads. However, the classification of modes does not exactly follow the requirements for classification presented by Bunge (1967, p. 73).

Niederman (2020) describes:

> Pentland over the years has developed a detailed and multi-faceted view of organizational routines. In addition to viewing broad categories of types of change, it may be worth looking freshly at the surface level of processes and their contributions and underlying mechanisms which create process and routine of varied sorts.

(E) data analysis/interpretation/argumentation

This article is conceptual, and thus it does not have observational data from reality. The argumentation seems carefully performed. However, we have minor questions, e.g., between ordinary and routine capabilities: Teece et al. state:

> Ordinary capabilities enable the production and sale of a defined (and hence static) set of products and services. Organizations need access to such capabilities, but they often do not need to practice them or own them, as they can often be outsourced. Ordinary capabilities stem from the proficient employment of the firm's human resources, plant and (tangible and intangible) assets, processes, and administrative systems, including the coordination needed to combine in-house and external resources. The strength of a firm's ordinary capabilities is a measure of its technical fitness. (Teece et al. 2016, p. 19)

Swanson explains a routine capability as follows:

> We introduce here the expanded notion of technology as routine capability, by which we simply mean the capability associated with device-enabled routines. Usually this entails the accomplishment of some task. That routines provide for such capabilities is well established in the literature, though often without much elaboration. (Swanson 2019, p. 1009)

Ordinary and routine capability seem to be almost similar, but are they really?

(F) results

Swanson summarizes his presentation well. We cite it as follows:

> In summary, our view of technology as routine capability offers a new perspective from which to conduct future research on technology and how it underpins most of what we do, as well as where we are presently going with it. It provides a coherent theoretical lens that ties together previous strands of research and shows how technological change by any one mode is intimately related to change by the others, suggesting that future research should explore these cross-modal changes, in particular. (Swanson 2019, p. 1021)

Literature review

Swanson does not perform a full-scale literature review. He says that:

> Drawing selectively from a fragmented literature, our aim is to bring routines to the foreground of the broader technology story, as we believe they deserve a more prominent position than commonly given, even by many routine theorists'. (Swanson 2019, pp. 1007-1008)

He also uses literature reviews performed by other researchers in different sections in the article.

4.5 Li and Chan (2019)

Li and Chan first conceptually develop a dynamic IT capability (DITC) framework for IT units and then in a literature review show which are DITC components and how they are associated with ordinary capabilities.

Abstract

> In a digital world, information technology (IT) units routinely update their capabilities to cope with changing business requirements and frequent technology releases. Extending the dynamic capabilities literature, this article presents the concept of *dynamic IT capability*, a multidimensional first-order dynamic capability that enables IT units to assist firms in appropriating business value from IT resources by influencing a set of IT-related ordinary capabilities. Scholars currently lack a dynamic capabilities framework that explains, from an IT unit's perspective, how IT resources can be acquired, deployed, integrated, and reconfigured to fulfill business objectives. To bridge this research gap, we develop a high-level framework that highlights three constituent components of dynamic IT capability: dynamic digital platform capability, dynamic IT management capability, and dynamic IT knowledge management capability. Through an extensive literature review, we identify and summarize the set of ordinary capabilities that each dynamic IT capability component creates and

> reconfigures. We then offer guidance on future instrument development. To encourage further exploration of this critical construct, we close by highlighting future avenues for dynamic IT capability research. (Li and Chan 2019)

On the article

Introduction

Li and Chan emphasize the importance of dynamic capabilities. The authors see that:

> For organizations to survive and thrive in competitive environments, their resources and processes need to be periodically, if not continuously, adjusted and reconfigured (Malhotra et al., 2007). The core idea is that when facing a competitive landscape involving complexity and uncertainty, dynamic capabilities enable organizations to achieve and sustain competitive advantages by staying adaptive (Teece, 2007). (Li and Chan 2019, p. 1)

Li and Chan take

> Digital technologies as combinations of information, computing, communication, and connectivity technologies. (Li and Chan 2019, p. 1)

The authors include, for example, customer relationship management (CRM) systems and enterprise resource planning (ERP) systems in digital technologies. They even use the terms IT and digital technologies interchangeably in this article.

The authors also list benefits of IT and related things: new business roles, enabling new business processes and boundary-spanning activities, generating new products and services, increasing customer engagement and facilitating innovation. Li and Chan define IT resources and practices as the combination of IT infrastructure and associated processes that "an organization leverages to fulfill its business objectives". They present that the provided IT services (i.e., the IT unit) must make the right IT functionalities available for use by the right people, at the right place and time.

Li and Chan refer to fast-evolving technologies, and that may produce pressure to build dynamic capabilities in IT unit. However, there is,

> a dearth of research on the roles played by IT resources in the formation of dynamic capabilities. (Li and Chan 2019, p. 2)

The authors continue:

> To our knowledge, there has been no discussion of the dynamic capabilities needed by IT units to support strategic business shifts. (Li and Chan 2019, p. 2)

Therefore, Li and Chan develop a dynamic IT capability (DITC) framework that was clarified later.

The DITC framework

Li and Chan introduce:

> DITC is rooted in the dynamic capabilities concept. In fact, DITC is a specific set of dynamic capabilities, developed by IT units, that enable organizations to appropriate value from digital technologies (Wheeler, 2002). (Li and Chan 2019, p. 2)

The authors describe:

> The DITC concept enables us to examine how IT units use three key dynamic capabilities – dynamic digital platform capability, dynamic IT management capability, and dynamic IT knowledge management capability – to extend, modify or create related ordinary IT capabilities. In this section, we introduce the dynamic capabilities concept and present our high-level DITC framework. (Li and Chan 2019, pp. 2-3)

In the subsection "Dynamic capabilities," the authors state that dynamic capabilities have been discussed in strategic management. Teece et al. (1997) first introduced the expression. Li and Chan state that dynamic capabilities are based on the resource-based view (RBV) and then refer to Peteraf. However, Barney (1991) might be a better reference.

Teece et al. (2016, p. 18) define dynamic capabilities as the firm's capacity to innovate, adapt to change, and create change that is favorable to customers and unfavorable to competitors. Teece et al. (2016) use a triplet: sense, seizure and transformation, instead of dynamic capability. Teece et al. (2016) also state that ordinary capabilities enable the production and sale of a defined (and thus, static) set of products and services. Organizations need access to such capabilities, but they often do not need to practice them or own them, as they can often be outsourced. In addition, Li and Chan differentiate dynamic and ordinary capabilities.

Li and Chan present:

> DITC as a first-order dynamic capability with three constituent components that IT units within organizations develop in order to plan, execute, and assess changes to IT-related ordinary capabilities (Drnevich and Kriauciunas, 2011; Winter, 2003). (Li and Chan 2019, p. 3)

The authors motivate the reader:

> among the multiple strategic management review articles on dynamic capabilities in the recent decade, none has focused on the role of IT in forming dynamic capabilities held by IT units. (Li and Chan 2019, pp. 3-4)

In the subsection "A high-level DITC framework," Li and Chan describe that:

> As IT resources become increasingly associated with business value creation, the processes and routines for IT innovation and adaptation are beginning to draw attention in dynamic capabilities research (e.g., Chen et al., 2008; Daniel and Wilson, 2003; Kim et al., 2011; Lim et al., 2011). Adopting the dynamic capabilities framework introduced by Winter (2003) and the typology of IT capability developed by Bharadwaj (2000), we propose a high-level DITC framework that links IT resources, IT-related ordinary capabilities, and DITC, as shown in Fig. 1 [Figure 18]. (Li and Chan 2019, p. 4)

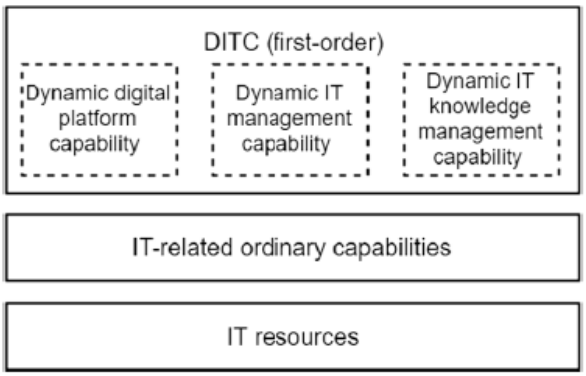

Figure 18 High-level DITC framework (Li and Chan 2019, p. 5)

Reprinted from Publication *Journal of Strategic Information Systems* (28:4), Li, T. and Chan, Y. E. 2019. Dynamic information technology capability: Concept definition and framework development, 1-20, Copyright (2020), with permission from Elsevier

The authors explain that:

> Bharadwaj (2000) classified IT resources into three categories: IT infrastructure, human IT resources, and IT-enabled intangibles. Using this theoretical foundation, in a similar way, we present DITC as having three component dynamic capabilities that operate on ordinary capabilities to alter three categories of IT resources: one focused on infrastructure, a second on IT management, and a third on IT-enabled intangibles, in particular, on IT knowledge. Specifically, we identify the three constituent components of DITC as: 1) dynamic digital platform capability, 2) dynamic IT management capability, and 3) dynamic IT knowledge management capability. IT units rely on these DITC components to govern changes in IT-related ordinary capabilities (Bharadwaj, 2000; Santhanam and Hartono, 2003). In this way, IT units help organizations benefit from IT resources. (Li and Chan 2019, p. 4)

Li and Chan define dynamic digital platform capability:

> as the IT unit's capacity to appropriate value from the organization's IT infrastructural components. IT units rely on IT infrastructure to support the sensing and seizing of business opportunities, and to support IT-enabled competitive and collaborative actions. (Li and Chan 2019, p. 4)

They also define that *dynamic IT management capability*:

> refers to the IT unit's ability to design and execute changes to business processes that control IT resources and practices in a manner aligned with the firm's goals and priorities. ... Dynamic IT management activities involve the design and execution of strategic IT plans (Daniel et al., 2014; Kim et al., 2011) as well as the identification of solutions to address unpredictable and novel developments (Pavlou and El Sawy, 2010). (Li and Chan 2019, p. 5)

Li and Chan define *dynamic IT knowledge management capability*:

> as the IT unit's capacity to facilitate firm-wide IT knowledge creation, transfer, and retention. IT knowledge refers to the technology expertise and managerial IT skills

> that are held by organizational members to carry out daily operations and seek improvement as needed (Kim et al., 2011; Ray et al., 2004). (Li and Chan 2019, p. 5)

(We emphasize that the first part of this study is conceptual and the second part a literature review.)

In the subsection "Review method," Li and Chan describe their approach as follows:

> This study developed a comprehensive definition of DITC by carrying out an in-depth review of DITC-related articles in two literature streams: prestigious academic journals (AJ) in the IS discipline and leading practitioner-oriented journals (POJ). (Li and Chan 2019, p. 5)

The academic journals (AJ) the authors selected from the AIS eight best basket, and POJ journals were: *MISQ Executive, California Management Review, Harvard Business Review* and *Sloan Management Review*.

The authors state that they followed Webster and Watson's (2002) article and created the following sequence: paper selection, coding protocol development, formal coding and interpretation findings (Li and Chan 2019, Figure 2). They coded 79 articles (50 AJ, 29 POJ). More details of the methodology, the criteria for paper selection, and the procedures for the coding schema development are reported in Appendix B.

The extended DITC framework

Li and Chan state that they based a new more detailed framework for DITC on an in-depth review (Figure 19; Li and Chan 2019, Figure 3). In Figure 19, there are three dynamic capabilities: 1) dynamic digital platform capability, 2) dynamic IT management capability and 3) dynamic IT knowledge management capability). Each dynamic capability is related (in two directions) to three ordinal capabilities.

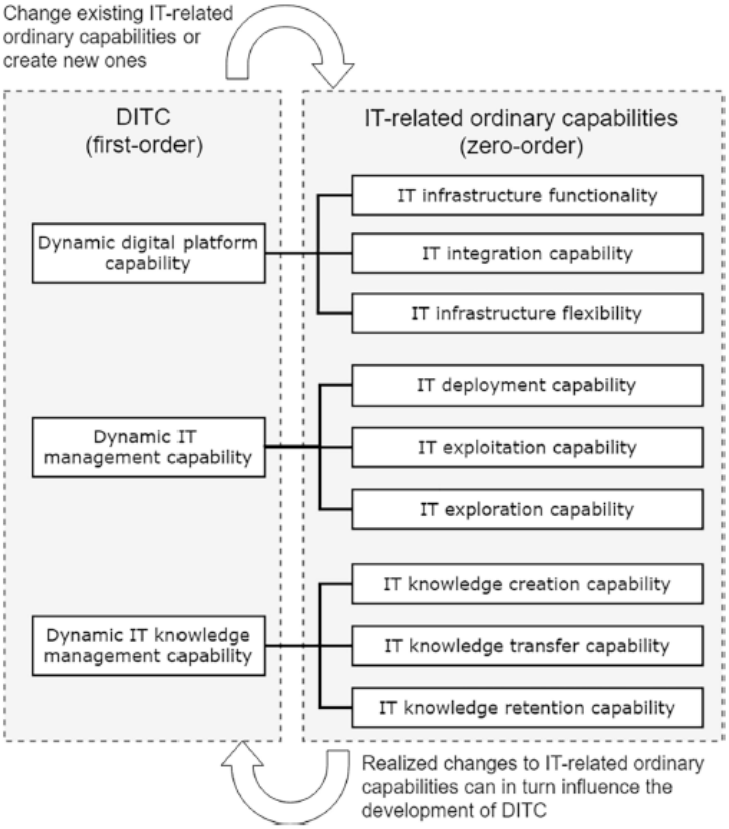

Figure 19 DITC components and associated ordinary capabilities (Li and Chan 2019, p. 8)

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Li and Chan describe Figure 19 verbally by explaining the upper arrow:

> We argue that dynamic digital platform capability influences ordinary capabilities related to the functionality, integration, and scaling needs of an organization's IT infrastructure. Dynamic IT management capability affects an IT unit's ability to systematically create and modify operational routines related to IT deployment, IT exploitation, and IT exploration. Dynamic IT knowledge management capability enables IT units to effectively govern the creation, transfer, and retention of IT knowledge in the organization. (Li and Chan 2019, p. 7)

The authors do not describe the lower arrow in Figure 19.

In the subsections "Dynamic digital platform capability," "IT infrastructure functionality," "IT integration capability," "IT infrastructure flexibility," "Dynamic IT management capability," "IT deployment capability," "IT exploitation capability," "IT exploration capability," "Dynamic IT knowledge management capability," "IT knowledge creation capability," "IT knowledge transfer capability" and "IT knowledge retention capability." Li and Chan describe and define these concepts in a similar way as in the conceptual development part of their article. There are few, if any, references to literature reviews.

Measuring DITC

Li and Chan generally evaluate their research domain:

> Digital technologies are shaping how organizations do business. The DITC concept focuses on the IT unit's capability to bridge the gap between IT resources and IT business value. The extended DITC framework we have developed enriches our scholarly understanding of how IT resources can be leveraged to meet changing business demands. As was earlier discussed, DITC is modeled as a first-order dynamic capability that has three components. Each component governs changes in IT-related ordinary capabilities. In the previous section, we summarized nine representative IT-related ordinary capabilities (i.e., three for each DITC component) discussed extensively in the literature. By mapping the connections between zero-order and first-order IT capabilities, our DITC framework paves the way for future exploration of DITC-related phenomena. (Li and Chan 2019, p. 11)

The authors encourage the researcher:

> Although we have conceptually introduced and described DITC, detailed measures are needed in order to practically assess the construct (Lewis et al., 2005). We recommend that scholars develop and validate several sets of measures – for the three components of DITC, and the IT-related ordinary capabilities that these components extend, modify or create (MacKenzie et al., 2011). Dynamic and ordinary capability specification in instrument development is needed to overcome current limitations in the DITC-related research (Laaksonen and Peltoniemi, 2016). (Li and Chan 2019, p. 11)

We recall that MacKenzie et al.:

> recognize that practical limitations may prevent researchers from being able to follow all of the recommendations discussed in this paper [MacKenzie et al. (2011)] in a single study, either because of a lack of time or resources, or both. Indeed, as noted by Nunnally and Bernstein (1994),
> Each scientist can perform only a relatively small number of major studies in a lifetime. This leaves insufficient time to do all that is required to specify the domain of a construct, develop measures of the construct, and relate these measures to other variables of interest (pp. 87-88). (MacKenzie et al. 2011, p. 329)

Future directions

Li and Chan first repeat their achievements and then propose future work (pp. 11-12):

> Adopting a dynamic capabilities perspective, this study introduces the DITC concept that captures the ability of the IT unit to acquire, deploy, integrate, and reconfigure IT resources and practices to fulfill business objectives. The pervasive adoption of IT has contributed to a climate of change and reinvention in business contexts, and has greatly increased the IT unit's salience in modern organizations. The definition of DITC and comprehensive framework presented provide a reliable starting point for future DITC studies. To move forward, we highlight five potentially high impact research areas: exploring the relationship between DITC and higher-order dynamic capabilities, using new analytical approaches to investigate different DITC configurations, adopting a practice-based view, exploring the micro-foundations of DITC, and studying the IT unit as a digital age capability driver. (Li and Chan 2019, pp. 11-12)

The authors then discussed each area.

Conclusion

Li and Chan (2019) inform that (p. 14):

> Our study makes four important theoretical contributions. First, we develop a fine-grained definition of the DITC concept that explains how an IT unit assists the firm in appropriating business value from IT resources and practices. Second, we conceptually differentiate DITC from resources, ordinary capabilities, and second-order dynamic capabilities. This distinction allows several research questions – at multiple levels – to be generated to extend our understanding of DITC. Third, we outline the current scope of DITC and pave the way for scholars to further explore the construct, its components, its antecedents, its impacts, and its measures. And lastly, we identify valuable future research avenues for DITC researchers. Our study contributes to practice as well. The DITC components, and the identified associated IT-related ordinary capabilities, can serve as diagnostic tools when an IT unit evaluates its capabilities and performance. IT managers can use this assessment as a starting point to seek future improvement, and to cultivate DITC components as needed. Organizations at different digitization stages may need to nurture different DITC components. In this article, we propose five future research avenues that merit scholarly attention. (Li and Chan 2019, p. 14)

The authors state 1) high-quality scientific journals, 2) special formalisms of practice-journals, 3) lack of interrelationships of capabilities in Figure 19 and 4) the high-level DTC framework are limitations.

Review

We evaluate the topic of the article positively. The authors progressed in the conceptual part. However, we cannot fully appreciate this article, because we found many problems. For example, in this article there is: "Received 1 May 2017; Received in revised form 27 September 2019; Accepted 28 September 2019". The citation shows that the manuscript was with authors more than two years, and the corrected version was then accepted within one day. The latter could describe either the policy of this journal or that a re-check concerning corrections was not performed.

Methodology

This article has a conceptual portion and a literature review portion. Hirschheim (2008) considers conceptual studies and then (D) theoretic foundation, (E) data analysis/interpretation/argumentation, (F) results. In Chapter 3, we analyzed literature reviews.

(D) theoretic foundation

There are at least two views or citations that we think demonstrate the authors might not have mastered their domain:

> (1) The dynamic capabilities perspective originates from the resource-based view (RBV) (Peteraf et al., 2013). (Li and Chan 2019, p. 3)

Normally we refer to Barney (1991) in connection with the RBV.

> (2) Among the multiple strategic management review articles on dynamic capabilities in the recent decade, none has focused on the role of IT in forming dynamic capabilities, let alone dynamic capabilities held by IT units. (Li and Chan 2019, pp. 3-4)

Nevertheless, the authors want to base their work on dynamic capabilities with IT units, although an IT unit is a supporting unit, not primary one, in a company.

In Figure 18, there are the whole and parts only, for example, entity x is a part of some larger entity X, not type a → b relationships. Although we always need concepts and often relations between the whole and parts, we also need precedence relations a → b.

(E) data analysis/interpretation/argumentation

Bharadwaj states:

> Although proponents of the resource-based view generally tend to define resources broadly, to include assets, knowledge, capabilities, and organizational processes. Grant (1991) distinguishes between resources and capabilities and provides a classification of resources into tangible, intangible, and personnel-based resources. Tangible resources include the financial capital and the physical assets of the firm such as plant, equipment, and stocks of raw materials. Intangible resources encompass assets such as reputation, brand image, and product quality, while personnel-based resources include technical know-how and other knowledge assets including dimensions such as organizational culture, employee training, loyalty, etc. (Bharadwaj 2000, p. 171)

We compare the text cited above with the text Li and Chan produce in their article (see Table 38).

Table 38 Comparison of Bharadwaj (2000) and Li and Chan (2019)

Researchers	**Type 1**	**Type 2**	**Type 3**
Bharadwaj (2000): Resources	Tangible (financial capital and the physical assets of the firm such as plant, equipment, and stocks of raw materials)	Personnel-based resources (technical know-how and other knowledge assets including dimensions such as organizational culture, employee training, and loyalty)	Intangible (intangible resources encompass assets such as reputation, brand image, and product quality)
Li and Chan (2019): IT resources	IT infrastructure	human IT resources	IT-enabled intangibles
Li and Chan (2019): DITC as having three component dynamic capabilities that operate on ordinary capabilities to alter three categories of IT resources	one focused on infrastructure,	a second on IT management,	and a third on IT-enabled intangibles, in particular, on IT knowledge
Li and Chan (2019): Three constituent components of DITC	1) dynamic digital platform capability.	2) dynamic IT management capability.	3) dynamic IT knowledge management capability.

We cited Bharadwaj (2000) exactly in the text before Table 38 and in the second row of the table. Then we take the third, fourth and fifth rows from Li and Chan's text. Li and Chan claim that it is possible to derive from the second row (Bharadwaj 2000) to the fifth row (Li and Chan 2019). We think that it is not possible for the following reasons:

1. Bharadwaj (2000) considers all type types of resources, not IT only
2. The steps from row 2 → to row 3, row 3 → row 4 and row 4 → row 5 are problematic; as follows:
   - From row 2 → to row 3, Li and Chan do not exactly follow Bharadwaj, for IT and IT-enabled are not explained, and resource is not IT infrastructure only.
   - From row 3 → to row 4, Li and Chan do not demonstrate that IT knowledge is intangible.
   - From row 4 → to row 5, Li and Chan do not explain that IT knowledge management could be managed by software and by people. The latter belongs to type 2, i.e., to personnel-based management.

However, row 5 could be derived from other structures, e. g., from three types of resources (technical, social and informational; Järvinen 2012).

(F) results

The authors mainly give preparatory frames. The authors hope many things will be developed in the future.

Literature review

The authors refer to Webster and Watson (2002) but not to other important references (cf. Chapter 3). Thus, Li and Chan develop their own literature review method. Therefore, we are afraid that there are problems that the authors did not report. First, Li and Chan do not describe how they developed Figure 19. Second, there are no instruments for measuring capabilities. The authors do not report how they perceived triplets (IT infrastructure functionality, IT integration capability, IT infrastructure flexibility and IT deployment capability, IT exploitation capability, IT exploration capability and IT knowledge creation capability, IT knowledge transfer capability, IT knowledge retention capability). No ordinary capability is defined.

Li and Chan cite as follows:

> The IS literature has predominantly viewed IT units as the source of IT capabilities in the firm (Pavlou and El Sawy, 2006). (Li and Chan 2019, p. 2)

The whole sentence is:

> Also, the literature has predominantly viewed IT capability as arising from within the IT unit, alas ignoring the role of business users (or "clients") to strategically leverage IT. (Pavlou and El Sawy 2006, p. 198)

The authors (Li and Chan) seem to use only the first part of the sentence. They do not take the last part into account. Later, Pavlou and El Sawy confirm their object of study (new product development, NPD, unity):

> Finally, the literature has primarily viewed IT capability to arise from within the IT unit. To address these issues, we developed a new process-level construct called IT leveraging competence in NPD [new product development]. The proposed construct draws on the firm-level IT capability literature, but it takes into consideration the unique characteristics of the NPD process to focus on the leveraging competence of NPD work units (as business users, or clients) outside the IT unit. (Pavlou and El Sawy 2006, p. 220)

These citations show the following:

a) The reviewers were not sufficiently careful in their evaluation of the first submission of this article.
b) A reference in almost every part of a sentence can mislead a reader, e.g., reviewer
c) This article focus on the IT unit and its IT capabilities only.
d) Generally, the IT unit is one of the support functions, not a primary function, such as production, sales and marketing.

4.6 Sarker et al. (2019)

This article concerns a central topic, what constitutes the IS signature. Sarker et al. (2019) referring to Abbott (2001, 2002, 2010) recommend the socio-technical perspective as signature or an axis of cohesion. We present the abstract, the main content and finally our review of the article.

Abstract

> The socio-technical perspective is often seen as one of the foundational viewpoints—or an "axis of cohesion"— for the Information Systems (IS) discipline, contributing to both its distinctiveness and its ability to coherently expand its boundaries. However, our review of papers in the two leading IS journals from 2000 to 2016 suggests that IS research has lost sight of the discipline's socio-technical character—a character that was widely acknowledged at the discipline's inception. This is a problem because an axis of cohesion can be fundamental to a discipline's long-term vitality. In order to address this issue, we offer ways to renew the socio-technical perspective so that it can continue to serve as a distinctive and coherent foundation for the discipline. Our hope is that the renewed socio-technical frame for the IS discipline discussed in the paper holds potential to contribute to the enduring strength of our diverse, distinctive, yet unified discipline. It also prompts members of the discipline to think more deeply about what it means to be an IS scholar. (Sarker et al. 2019)

On the article

Introduction

Sarker et al. motivate the reader:

> ... we appear to be losing the grounding that the socio-technical perspective has traditionally provided for our research and teaching, leaving the discipline exposed to potential dangers with respect to its long-term vitality. Such dangers might include (1) disciplinary erosion due to a lack of uniqueness; (2) disciplinary fragmentation due to the discipline's inability to expand in a coherent fashion, and the resulting absence of a shared understanding of topics among its different sub communities; and (3) a lack of ethical standing of the discipline in society ... . (Sarker et al. 2019, p. 696)

The cited phrase contains the three main aspects that are emphasized in the article.

The Socio-technical Perspective and IS

The authors describe the historical roots of the socio-technical perspective beginning with the Tavistock Institute. They mention that

> Building on these early developments, the IS discipline further drew upon ideas from the socio-technical tradition for uniquely studying information technology and its relationship with individuals and social collectives (Bostrom and Heinen 1977a, 1977b). (Sarker et al. 2019, p. 697)

The authors also mention as the basis of socio-technical perspective as "Effective Technical and Human Implementation of Computer Based Systems" (ETHICS) (Mumford and Weir 1979) and soft system methodology (Checkland and Scholes 1990).

According to Sarker et al.,

> Cecez-Kecmanovic et al. (2014, p. 814) explain how the body of socio-material scholarship emerged from socio-technical thinking: By drawing attention to, and encouraging deeper insights into, the intertwining and interpenetration among technological and human processes, the socio-technical systems approach paved the way for socio-material thinking. (Sarker et al. 2019, pp. 698-699)

Sarker et al. take a simple view and elaborate that

> the socio-technical perspective in IS, as depicted in Figure 1 [Figure 20], conceptualizes the social and the technical as two mutually interacting components (Alter 2013). (Sarker et al. 2019, p. 697)

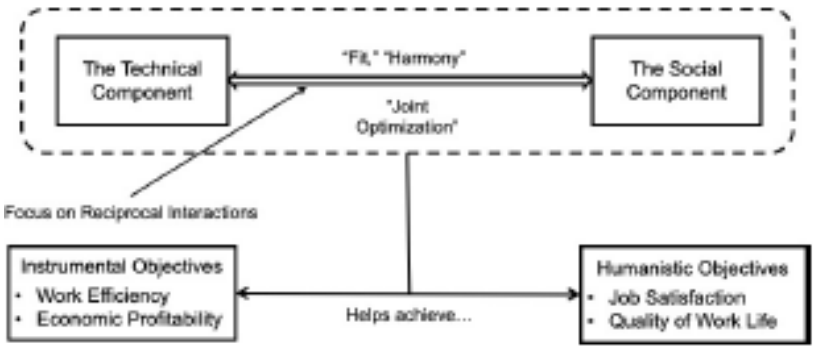


Figure 20 A representation of the socio-technical perspective in IS (Sarker 2019, p. 698)

Sarker et al. state that:

> A basic question for many of us is: What is a discipline? According to Fabian (2000, p. 351), "a discipline refers to the common focus of a set of researchers who might perform research in varied paradigms and/or theoretical perspectives." ... A discipline not only demands a coherent tradition, but also necessitates a unique perspective in order to identify, support, and/or legitimize research within that discipline (Fabian 2000). (Sarker et al. 2019, p. 699)

Abbott (2001) offers an axis of cohesion for every discipline, and Sarker et al. emphasize that

> by disciplinary distinctiveness we do not mean that the discipline is concerned with phenomena that are not of interest to other disciplines; rather, distinctiveness relates to how a discipline might investigate a phenomenon of interest, and to the knowledge that would result from the discipline's engagement with the phenomenon, using its unique perspective. (Sarker et al. 2019, p. 700)

The authors propose that a socio-technical perspective could be an axis of cohesion for the IS discipline.

The authors write that:

> the rest of our paper is structured as follows. First, we undertake an extensive review of literature—papers published in MIS Quarterly and Information Systems Research from 2000 to 2016—to derive insights on how IS researchers have enacted (or not enacted) the socio-technical perspective. We then critically analyze the results and offer recommendations regarding how we might modify our current understanding of the socio-technical perspective so that it continues to offer an integrative and compelling foundation for the IS discipline. (Sarker et al. 2019, p. 701)

The Socio-technical Perspective as Enacted in Contemporary IS Studies

Sarker et al. inform that:

> based on Figure 1 [Figure 20], our analysis examined two broad aspects: (1) how studies have enacted *the presence of the social and the technical* in conceptualizing IS phenomena *and the relationship between the social and the technical*; and (2) what kind of *outcomes/objectives* the studies have focused on. The literature review shows that the relationship between the social and the technical has been conceptualized in different ways within the studies reviewed. We categorize these different conceptualizations into six types (I-VI) and discuss them below. With respect to the nature of outcomes, the investigation revealed that the majority of the reviewed studies (91%) have focused exclusively on instrumental goals. Only 7% of the studies have considered both humanistic and instrumental goals; the remaining 2% of studies have been concerned with humanistic goals alone. (Sarker et al. 2019, pp. 701-702)

The authors explain their literature review:

> The qualifying criteria for the articles to be included in the sample were that the article (1) employs an empirical component and (2) that the empirical component is examining an IS-related phenomenon. This excludes empirical papers that examine IS scholars' views on promotion, journal quality, etc. Also, theoretical articles including statistical measuring debates, methodological views, editorials, and literature reviews were omitted from the sample. Further, two more articles were dismissed during the coding process due to their unique nature (see the more detailed explanation below). Therefore, in total, 228 articles are excluded from our review. This left us with 991 articles that were included in

> the analysis. These consist of 484 articles published in MISQ and 507 articles published in ISR. (Sarker et al. 2019, pp. A1-A2)

In addition, the authors performed inductive coding (Bandara et al. 2015).

We do not describe the types but give Table 39. The proportion of studies in different categories are as follows: Type I 56 %, II 6 %, III 3 %, IV 13, V 15 % and VI 7 %. The proportions of studies based on the nature of the outcomes as follows: humanistic goals only 2 %, instrumental goals only 91 % and both 7 %.

Table 39 Summary of six categories (Examples column is lacking) (Sarker et al. 2019, Table A2)

Type	Name/Label	Description
I	Predominantly social	Either the investigation only focuses on the social component, and does not directly address technical component OR the investigation mostly focuses on the social component, and the technical component is addressed in an indirect or contextual way
II	Social imperative on the technical	Technology as a predominant outcome of social structures or processes
III	Social and technical as additive antecedents to outcomes	Both social component and technical component are antecedents to certain outcomes; however there is generally no evidence of any interaction between the components themselves while producing these outcomes.
IV	Social and technical as interactive to produce outcomes	Social and technical are both considered as critical to produce outcomes, but the focus is on the interplay between the two components (such as fit/alignment, reciprocal interactions, or entanglement/imbrication) that produce those outcomes
V	Technical imperative on the social	Technology as the major antecedent to social outcomes, such as those in impact or evaluation studies
VI	Predominantly technical	Focusing solely on how to develop or improve the technical (e.g., database algorithm) and very limited and direct concern about the role of the social.

Reflections Based on the Review

Based on the results, the authors make three observations:

- Observation 1: The social and technical components are emphasized unequally.
- Observation 2: Relationships between the social and technical components vary.
- Observation 3: The predominant focus is on instrumental goals.

Making Sense of Our Observations: Possible Implications

Sarker et al. highlight

> three potentially negative implications of this trend that we had briefly alluded to earlier, derived from Abbott's analysis of disciplines. First, by moving away from the socio-

> technical perspective, the IS discipline risks losing its distinctiveness, leading to possible uncomfortable questions about its disciplinary legitimacy down the road. Second, the IS discipline risks becoming increasingly fragmented as it seeks to expand without a unifying, shared frame in the discipline. And, third, by losing sight of humanistic goals, the IS discipline risks facilitating the creation of a dehumanized and dystopian society. (Sarker et al. 2019, p. 705)

Looking Forward: Re-envisaging and Recommitting to the Socio-technical Perspective

When the authors look forward to envision and recommit to the socio-technical perspective, they make three recommendations:

Recommendation 1: Recognize IS problems as consisting of social and technical aspects along a continuum.

Recommendation 2: Accept variations of socio-technical relationships.

Recommendation 3: Connect humanistic and instrumental outcomes in a synergistic manner.

Review

We must protect our discipline, and Sarker et al.'s (2019) proposal is welcome. We especially appreciate their proposal with two important components of IS, social and technical. This also brings two-dimensional relationships that will increase the potentialities considerably. Benbasat (2004) explains that data, information or knowledge resource is included in IT (this concerns Benbasat and Zmud 2003).

Baskerville et al. (2020) state (p. 519): "The ontological reversal may also bring about a degree of reversal in the relationship between the social and the technical. In our digital world, we may need to complement this socio-technical perspective with a techno-social perspective." Sarker et al. (2019) demonstrate that all types of socio-technical studies already exist. Do Baskerville et al. to emphasize a two-directional relationship between social and technical components or did they forget Sarker et al. (2019)?

The Sarker et al. (2019) article is conceptual and has a literature review as the basis for their proposals. Hirschheim (2008) considers conceptual studies and then (D) theoretic foundation, (E) data analysis/interpretation or argumentation and (F) results.

Methodology

(D) Theoretic foundation

Sarker et al.'s proposal of the socio-technical perspective for an axis of cohesion is not the first. Benbasat and Zmud propose that

> In fact, a natural ensemble of entities, structures, and processes does exist that serves to bind together the IS sub disciplines and to communicate the distinctive nature of the IS discipline to those in its organizational field—the IT artifact and its *immediate* nomological net. (Benbasat and Zmud 2003, p. 186)

Benbasat and Zmud drew Figure 21. We found that "impact" is the only concept that is more than one step from the IT artifact.

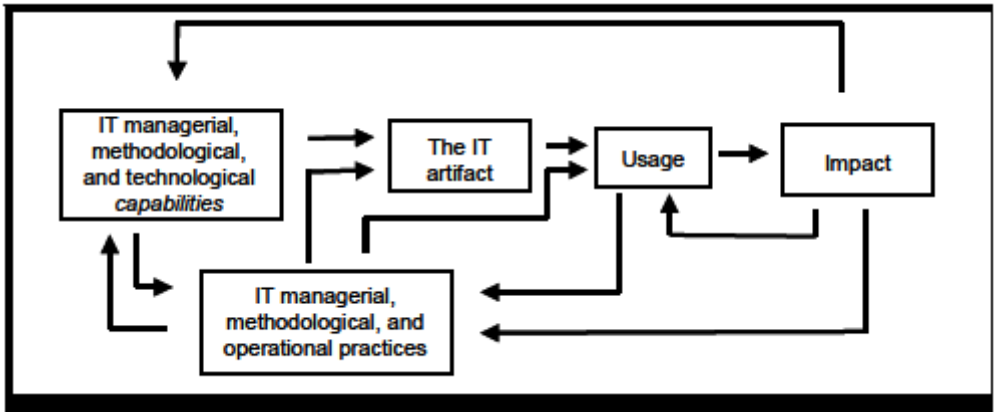


Figure 21 IT artifact and its intermediate nomological net (Benbasat and Zmud 2003, p. 187)

We consider that in organizations there are four kinds of resources: λ (technical), ω (social), ι (informational) and φ (financial); the first three can be bought with φ. The authors consider two (λ, ω) only, but information (ι) plays a central role in IS, as Lee et al. (2015) nicely show in connection with information systems.

Mumford writes that the socio-technical approach

> will be difficult to use successfully if parties involved are hostile to each other, disinterested in developing strategy and unwilling or unable to cooperate. (Mumford writes 2006, p. 316)

(E) data analysis/interpretation/argumentation

Two of the authors classified and coded the articles included in this study. At the end of the literature review, the whole group of authors accepted the classification. The authors seem to accept that editors (and reviewers) in *MISQ* and *ISR* (not the authors) decided whether a certain submission belongs to IS studies.

In IS studies, most relationships are unidirectional (a → b). A two-directional relationship (a ↔ b) is rare, and in the IS literature, there are seldom guidelines for two-directional relationships and few examples. Type IV is a two-directional relationship, but the authors do not sufficiently pay attention to two-directionality.

(F) results

The authors do not like a situation where type I and VI studies cover about 63 %, but they do not exclude them from IS studies although there is a danger that the distinctiveness of IS may be harmed.

Literature review

The authors performed inductive coding (Bandara et al. 2015). This means that the authors did not describe (or differentiate) the socio-technical perspective

beforehand. Thus, they did not form a classification scheme before the study. They did not later check the exhaustiveness at the dimensions or class level.

4.7 Vial (2019)

Vial studies digital transformation (DT) based on previous studies, derives a framework for DT and proposes two avenues of new research, dynamic capabilities and ethics in connection with DT.

Abstract

Extant literature has increased our understanding of specific aspects of digital transformation, however we lack a comprehensive portrait of its nature and implications. Through a review of 282 works, we inductively build a framework of digital transformation articulated across eight building blocks. Our framework foregrounds digital transformation as a process where digital technologies create disruptions triggering strategic responses from organizations that seek to alter their value creation paths while managing the structural changes and organizational barriers that affect the positive and negative outcomes of this process. Building on this framework, we elaborate a research agenda that proposes [1] examining the role of dynamic capabilities, and [2] accounting for ethical issues as important avenues for future strategic IS research on digital transformation. (Vial 2019)

On this article

Vial motivates his article by stating:

> In recent years, digital transformation (DT) has emerged as an important phenomenon in strategic IS research as well as for practitioners. (Vial 2019, p. 118)

He continues that

> we currently lack a comprehensive understanding of this phenomenon as well as its implications at multiple levels of analysis. (Vial 2019, p. 118)

Vial states his research question:

> "What do we know about digital transformation?" (Vial 2019, p. 118)

In Appendix A, Vial states:

> In their work on the use of grounded theory techniques to perform literature reviews, Wolfswinkel et al. (2013) proposed five main steps which they further break down into eleven tasks that guide the review process from its inception until the actual writing of the review article. (Vial 2019, p. A-1)

The author outlines the application of those tasks and collected 282 articles. He also states:

> Based on extant definitions, we develop a conceptual definition of DT as "a process that aims to improve an entity by triggering significant changes to its properties through

combinations of information, computing, communication, and connectivity technologies". (Vial 2019, p. 118)

Introduction

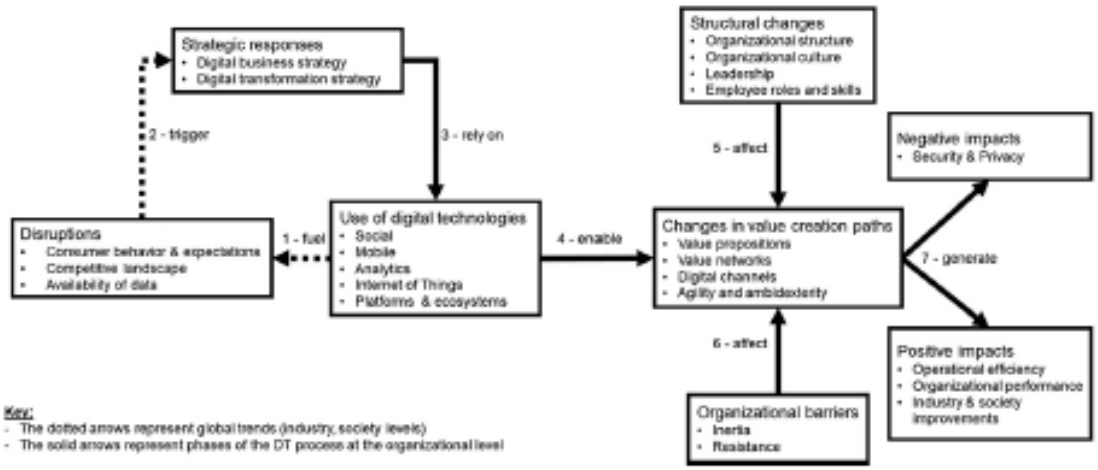
Vial promises to present, based on an analysis of the literature, an inductive framework (Figure 22) describing DT. He then compares the DT transformation with the IT-enabled transformation and shows small differences. Vial ends the article by proposing a research agenda for strategic IS research on DT.

Method

Vial describes how he applied an approach developed by Wolfswinkel et al. (2013). Appendix A helps readers to understand how the sample (282 works) was collected.

Findings

Vial first shows how he developed a new definition for DT by applying Wacker (2004) and Suddaby (2006). He collected 28 sources offering 23 unique definitions. Vial criticizes the traditional definitions and then forms his own. Then the author constructs a framework for DT.



Key

- The dotted arrows represent global trends (industry/ society levels)
- The solid arrows represent phases of the DT process at the organizational level

Figure 22 Building blocks of the DT process.

Reprinted from Publication *Journal of Strategic Information Systems,* (28), Vial, G. 2019. Understanding digital transformation: A review and a research agenda, 118–144, Copyright (2020), with permission from Elsevier

Note: The arrows do not represent a statistical relationship or a causality found in variance models. Rather, they detail an overarching sequence of relationships described by the literature on DT. (Vial 2019, p. 122)

Vial presents:

> in Fig. 1 [Figure 22] and in the sections below our inductive framework summarizing current knowledge on DT. This framework builds upon relationships that emerged through our analysis across eight overarching building blocks describing DT as a process where digital technologies play a central role in the creation as well as the reinforcement of disruptions taking place at the society and industry levels. These disruptions trigger strategic responses from the part of organizations, which occupy a central place in DT literature. Organizations use digital technologies to alter the value creation paths they have previously relied upon to remain competitive. To that end, they must implement structural changes and overcome barriers that hinder their transformation effort. These changes lead to positive impacts for organizations as well as, in some instances, for individuals and society, although they can also be associated with undesirable outcomes. (Vial 2019, p. 122)

Digital transformation and IT-enabled transformation

Vial tries to show small differentiations, and he seems to conclude that "digital transformation" evolved from "IT-enabled transformation". Vial emphasizes DT and its potential positive impacts.

Digital transformation: a research agenda

Vial views that

> Our review highlights the significant contributions that research has made toward our understanding of DT. In this section, we extend these contributions through the outline of an ambitious agenda comprising two avenues for future strategic IS research and practice on DT. The first avenue is the contribution of dynamic capabilities as a theoretical foundation to study DT. The second avenue is the incorporation of ethics in strategic IS research on DT. (Vial 2019, p. 133)

Review

Having reviewed the literature on DT, Vial emphasizes its novelty and importance. He uses an approach developed by Wolfswinkel et al. (2013) for creating a framework (Figure 22). This framework may provide a good basis for researchers in the future. His approach is conceptual.

Methodology

According to Hirschheim (2008), three main aspects of conceptual studies are: (D) theoretic foundation, (E) data analysis/interpretation/argumentation and (F) results.

(D) theoretic foundation

Every article has much repetition. The main content is written five times: title, abstract, introduction, discussion and the body proper. In the Vial's article, the abstract and the introduction are very similar, and they correspond well to the body. Vial gives as the title of his article "Understanding digital transformation: A review and a research agenda", but he could write "knowing" instead of "understanding." His research question asks “What do we know about digital transformation?" The body proper of this article tries to answer the research question. The Discussion section is literally lacking, but concerning its content,

there are "limitations" and other discussion content (implications for science and practice plus research in the future) partially in the Conclusion. Thus, Vial repeats similar content five times in his article.

In building blocks of the DT process (Figure 22) there are some deficiences:

1. Figure 22 and its box "Use of digital technologies" contain "Social", "Mobile", "Analytics", "Internet of Things" and "Platforms & ecosystems". "Analytics" is not a technology but statistical computing or similar, although it is often performed with a computer.
2. The box "Changes in value creation paths" contains "Digital channels". The expression "value creation" means that Vial explores utility. But the author does not specify how utility is measured.
3. The box "Structural changes" seems to consist of "Organizational structure", "Organizational culture", "Leadership" and "Employee roles and skills". In GT, some primary texts are collected in a larger category, then the categories form a new even larger category and finally, a category similar to "Structural changes". We ask, do the lower categories "Organizational structure", "Organizational culture", "Leadership" and "Employee roles and skills" form the category "Structural changes"? Vial does not give an answer to our question.
4. Vial refers to Wolfswinkel et al. (2013), and the latter refer to Strauss and Corbin (1990), when Vial conducted a literature review by using a grounded theory (GT) and by performing open, axial and selective coding. Then, a researcher (Vial) gives names for upper categories. A reader must exactly understand Vial's names, but it is not believable.

(E) data analysis/interpretation/argumentation

Vial analyzes a group of works and their definitions of DT. He revealed that circularity, unclear terminology and the conflation of the concept and its impacts, among other challenges, hinder the conceptual clarity of DT. However, this is not the end of his analysis.

(F) results

Vial (2019) states (p. 131): "IT carries transformative potential," and it can offer four possibilities (automate, informate-up, informate-down and transform). Transforming is intended for "redefining the business model, business processes and relationships of the firm." We should think about, to what extent IT's potential (e.g., text or article, movie and/or song in an electronic form) can transform the business model, business processes and relationships of the firm.

Literature review

Vial searched (p. A-1)

> online databases (AIS Library, Business Source Complete, Science Direct, Web of Science) for peer-reviewed journal articles and conference proceedings against the keyword "digital transformation". (Vial 2019, p. A-1)

He states that he used the Web of Science a little. This may not meet some methodology standards. For example, Kitchenham et al. (2009) prefer four or more databases.

In applying Wolfswinkel et al. (2013) and grounded theory (GT), Vial concentrates on two tasks:

1. Vial applies

> axial coding to refine our coding scheme and categorize codes based on their meanings. For instance, first-order categories such as 'experience with digital mergers and acquisition' and 'new ecosystem relationships' were grouped under a higher-level category labeled 'strategic partnerships'. (Vial 2019, p. A-5)

He does not explain why this type of grouping is possible.

2. Vial also observes two points:

> First, two of our categories, *digital divide* (a negative impact at the society level; 9 sources) and *digital entrepreneurship* (a structural change that helps organizations create value using digital technologies; 8 sources), are provided here but have been omitted from the paper because they were significantly under-represented compared to other categories. (Vial 2019, p. A-8)

Vial does not state what happened to some (9 and 8) sources. Do they belong to material in the continuing processing or not?

Generally, we assume that a review contains empirical research articles. Vial, however, collected also other works, shown in Table 40.

Table 40 Breakdown of non-empirical research articles (n = 68) (Vial 2019, Table C-4)

Research - other (literature review)	17
Research - other (conceptual)	14
Research - other (discussion)	7
Research - other (commentary)	7
Research - other (intro so special issue)	6
Research - other (issues & opinion)	6
Research - other (essay)	4
Research - other (editorial)	3
Research - other (bibliometric study)	1
Research - other (catchword)	1
Research - other (methodological)	1
Research - other (modeling)	1

Kitchenham et al. (2009) classify literature reviews as secondary studies, not primary ones. To this end, a literature review does not belong in the category "primary studies". In Table 40, there can also be other works that should not belong to the material of Vial's study.

4.8 Hadjimichael and Tsoukas (2019)

The authors analyze and classify studies of tacit knowledge (TK) in management. They express that:

> the increasing emphasis on the importance of TK has enriched management theorizing. However, without developing a coherent understanding of the different uses of TK in management research, limited progress can be hoped to be achieved. (Hadjimichael and Tsoukas 2019, p. 673)

Abstract

> Tacit knowledge is the knowledge that we draw on in use, but is difficult to have consciousness of, or to express in language. The proliferation in the use of tacit knowledge in management research has generated a diversity of understandings that has reduced the clarity of the concept. In this review, our main goal was to contribute to an integrative theorizing of tacit knowledge. In particular, we aim to grasp the different understandings of tacit knowledge, trace them to the onto-epistemological assumptions researchers make concerning the nature of knowledge and action, and suggest a framework that enables researchers to get a coherent understanding of the diverse literature. We identify three perspectives on tacit knowledge: the conversion, interactional, and practice perspectives. We describe each perspective, trace its development to particular ontological and epistemological commitments, and discuss commonalities and differences. Furthermore, we reflect on methodological issues and suggest possibilities for further research, including the relationship between artificial intelligence and tacit knowledge. (Hadjimichael and Tsoukas 2019)

On the article

Introduction

Hadjimichael and Tsoukas

> seek to overcome the preceding limitations of hitherto reviews by increasing the scope of our review and organizing it in terms of comprehensive analytical categories. Specifically, in terms of scope, we extend the range of our review by (a) including studies at both the individual and collective levels of analysis and (b) focusing on the relationship of TK with a range of constructs in management research (e.g., performance, strategy, and knowledge sharing). (Hadjimichael and Tsoukas 2019, p. 673)

The authors continue (p. 674):

> For our review, we carried out a database search in the ISI Web of Knowledge to identify studies that had the key words "tacit knowledge' and its synonyms (i.e., "know-how," "procedural knowledge," and "implicit knowledge") in 17 leading journals. (Hadjimichael and Tsoukas 2019, p. 674)

They found 251 articles and excluded 80 articles from their review, thus leaving 171 articles. Additionally, they read studies published in books (Collins 2010; Nonaka and Takeuchi 1995; Polanyi 1958, 1966b; Ryle 1949; Tsoukas 2011). Hadjimichael and Tsoukas state:

> In reading each study included in this review, we searched for their onto-epistemological assumptions and sought commonalities across them. This exercise (which will be detailed

> later) enabled us to create an organizing framework for our review. (Hadjimichael and Tsoukas 2019, p. 674)

The authors inform the reader that they

> search for the underlying ontological-epistemological (hereafter: onto-epistemological) assumptions of the reviewed studies to identify distinct perspectives on TK. The reason for doing this is that onto-epistemological assumptions provide researchers with 'a system of picturing' that structures how researchers conceptualize and empirically explore TK. We distinguish two onto-epistemological platforms: intellectualist and phenomenological. An intellectualist onto-epistemology assumes that TK and other types of knowledge are discrete entities that have inherent and relatively stable characteristics. A phenomenological onto-epistemology assumes that TK and other types of knowledge are intertwined, inscribed in bodily skills, and embedded in socio-material practices. The intellectualist onto-epistemology privileges the detached observer's perspective, whereas the phenomenological gives priority to the agent's lived experience. (Hadjimichael and Tsoukas 2019, p. 674)

Philosophical foundations of tacit knowledge

Hadjimichael and Tsoukas use two sources, Ryle (1949) and Polanyi (1958, 1966b). The studies by Ryle (1949) and Polanyi (1966) are included in the group of books in which they read studies. Hadjimichael and Tsoukas observe that Ryle argues against an intellectualist understanding of knowledge. Ryle (p. 674) "makes the distinction between 'know-how' and 'know-that' to argue against the intellectualist view." Ryle notes that know-how is the tacit knowledge one requires to intelligently execute an action, whereas know-that is explicit knowledge about the action (i.e., it describes the execution of an action).

According to the authors, in his books (*The Tacit Dimension* and *Personal Knowledge*),

> Polanyi makes a similar argument to that of Ryle but focuses more on formulating the underlying mechanisms of know-how. Polanyi defines know-how as tacit knowledge, or to be more precise, as tacit knowing. In particular, Polanyi argues that tacit knowing is not a static body of knowledge, but a perceptual process that relies on the integration of 'focal' and 'subsidiary' awareness. The integration of subsidiary and focal awareness is referred to as indwelling. By stressing that indwelling occurs tacitly, Polanyi, like Ryle, maintains that all knowledge is rooted in tacit knowledge (or know how). (Hadjimichael and Tsoukas 2019, p. 675)

The literature of tacit knowledge in management research

The authors sought onto-epistemological assumptions, and therefore, they try to identify two steps:

> First, we searched for the underlying onto-epistemological 'image of thought' (Morgan, 1997: 4; Tsoukas, 2019: 3) that underlies the conceptualization of TK in each study. Two images of TK were identified. Studies conceive of TK either as an entity that can be converted, transmitted, or combined (an intellectualist image) [see, e.g., the work of Nonaka (1994)], or as an accomplishment that integrates subsidiary and focal awareness on an ongoing basis (a phenomenological image) (see, e.g., the work of Tsoukas, [2011]). (Hadjimichael and Tsoukas 2019, p. 675)

Second, they search for the relationship between tacit and explicit knowledge that is argued for, or presumed by, each study.

Hadjimichael and Tsoukas identify three different types of relationships across the reviewed studies. The *first type* (conversion) posits that TK can be unconditionally converted to explicit knowledge and vice versa, and that either type of knowledge can be used in action. Hadjimichael and Tsoukas continue as follows:

> The *second type* [interactional] posits that explicit and tacit knowledge must be joined together to perform a task. For example, by itself, having explicit knowledge (e.g., a recipe) is not enough to perform a task (e.g., bake bread). To use explicit knowledge, the latter must be joined together with TK (e.g., ability to read the recipe and engage in the bodily movements required) (see Ribeiro & Collins, 2007). The *third type* [practice] posits that tacit and explicit knowledge are mutually constituted, and that TK can only be partially articulated. Articulation is different from conversion: it involves a new context, in which the TK that is related to the action under focus is revisited and repunctuated (Tsoukas, 2011: 471). [italics added here] (Hadjimichael and Tsoukas 2019, p. 675)

Hadjimichael and Tsoukas conclude that:

> Through this two-step process, we have identified three perspectives in which, broadly, relevant studies fall: the conversion, the interactional and the practice perspectives (see Table 1 [Table 41]). Specifically, studies that conceive of TK as separate from explicit knowledge and assume the unconditional conversion of TK into explicit knowledge were grouped under the conversion perspective [an illustrative example is Nonaka (1994)]. Studies that conceive of TK as separate from explicit knowledge and assume that TK must be joined together with explicit knowledge for a task to be performed were grouped under the interactional perspective [an illustrative example is Cook and Brown (1999)]. Finally, studies that conceive of TK as an accomplishment and assume the inseparability of tacit and explicit knowledge were grouped under the practice perspective [an illustrative example is Tsoukas (1996)]. (Hadjimichael and Tsoukas 2019, p. 676)

Table 41 Assumptions of perspectives on tacit knowledge (TK) (Hadjimichael and Tsoukas 2019, p. 676)

	Conversion	**Interactional**	**Practice**
Image of knowledge	Outcome	Outcome	Process
Relationship between tacit and explicit knowledge	Tacit and explicit knowledge are interchangeable and mutually convertible	Tacit and explicit knowledge must be joined together	All knowledge is grounded in tacit knowledge
Locus of study	Primarily individual	Individual-cum-collective	Agent embedded in practice

The authors then review studies, but they do not all neatly fit into the three perspectives. The authors give one example per perspective from those they had difficulties. Then Hadjimichael and Tsoukas analyze:

> each of the identified perspectives in turn (for an overview, see Table 2 [Table 42]). (Hadjimichael and Tsoukas 2019, p. 677)

Table 42 Overview of perspectives (Hadjimichael and Tsoukas 2019, pp. 678-679)

Conversion Perspective	
Key concepts	
Tacit knowledge	A type of knowledge that is subjective, largely inaccessible to consciousness, tied to activity, and awaiting conversion into an explicit form.
Explicit knowledge	A type of knowledge that is objective, accessible to consciousness, and in close correspondence with theory.
Group/organizational tacit knowledge	A type of knowledge that is difficult to articulate and is the result of the combination of individual cognitive schemata acquired through mutual experience.
Primary mechanism	
Conversion	Conversion of tacit knowledge into explicit knowledge and vice versa. It is the key to becoming aware of tacit knowledge and being able to share it.
Research streams	
Foundational	Outlines key assumptions of the perspective, e.g., Nonaka and Takeuchi (1995). Through the discussion of different empirical cases, the authors illustrate the importance of tacit knowledge and the process of how it is converted to explicit knowledge and vice versa.
Performance	Outlines the links between tacit knowledge and performance, e.g., Shamsie and Mannor (2013). Through an analysis of data from Major League Baseball teams, the authors provide evidence of the importance of TK to team performance.
Knowledge management	Outlines ways of managing tacit knowledge in and across organizations, e.g., Lam(1997). The author suggests that the explication of tacit knowledge is essential to make it "easily understood and accessed by those who do not share a common experience or background" (p. 987).
Strategy	Outlines the links between tacit knowledge and strategic decisions (e.g., planning, mergers, acquisitions and organizational structure). For example, Le Breton-Miller and Miller (2015). The authors highlight that organizations should pay attention to the vulnerability of their resources (e.g., tacit knowledge and its ambiguity). To counter this issue, the authors suggest that organizations should strategize ways to codify and share tacit knowledge.
Interactional Perspective	
Key concepts	
Tacit knowledge	A type of knowledge largely inaccessible to consciousness and tied to activity that can only be conditionally converted.
Explicit knowledge	A type of knowledge that is objective, accessible to consciousness, and in close correspondence with theory.
Individual tacit knowledge	Tacit knowledge that is part of the cognitive and bodily schemata of individuals.
Collective tacit knowledge	Tacit knowledge embedded in norms of appropriateness; it is manifested in stories.
Individual explicit knowledge	Information/facts known by individuals.
Collective explicit knowledge	Information/facts shared by groups.
Key mechanism	

Interaction	Actions require the individual to join together tacit/explicit and collective/individual types of knowledge.
Research streams	
Foundational	Outlines key assumptions of the perspective. For example, Cook and Brown (1999). The authors argue that organizations can be better understood when explicit, tacit, individual, and group knowledge are treated as four separate but equal types of knowledge, which are enjoined through knowing during action.
Knowledge sharing	Outlines ways of sharing tacit knowledge in and across organizations. For example, Ribeiro and Collins (2007). The authors revisit the classic case of bread-making machine. Instead of conversion, they imply that different types of tacit knowledge were joined together to design the bread-making machine.
Practice Perspective	
Key concepts	
Tacit knowledge	Knowledge that is hard to express and be conscious of, which stems from the constant process of indwelling.
Explicit knowledge	Partially articulable knowledge that is embedded in tacit knowledge.
Key mechanisms	
Indwelling	The spontaneous integration of focal and subsidiary awareness in the act of knowing.
Practice	Normatively defined, taken-for-granted ways of performing activities and using language.
Research streams	
Foundational	Outlines key assumptions of the perspective. For example, Brown and Duguid (2001). Through the lens of communities of practice, it is suggested that epistemic differences are the result of different practices, rather than different types of knowledge (e.g., tacit/ explicit).
Skill	Outlines how practitioners experience tacit knowledge in organizations. For example, Tsoukas and Vladimirou (2001). By drawing on a case study of a telecommunication organization, the authors argue that organizational knowledge is simultaneously social and personal.

Hadjimichael and Tsoukas present three perspectives (conversion, interactional and practice) with their streams by describing their groupings of studies and often, the details of a study. When we look at research work, these details seem close to a certain study and well-done, but the framework (Table 41) and its derivation must still be discussed.

Discussion

Hadjimichael and Tsoukas discuss (i) the commonalities and differences between the three perspectives identified, (ii) methodological implications and (iii) directions for future research. The authors present three commonalities and differences. For methodological implications the authors identify some for outcome-oriented and some for process-oriented. Concerning new methodological approaches, we identify a recommendation for mixed-methods. The subsection "Directions for future research" contains six proposals.

Review

We appreciate that the authors found so many studies on tacit knowledge in management. Many are carefully analyzed, and the analysis may help new researchers to study this topic.

Although we appreciate this article, we have some comments. This article mainly contains a literature review.

Literature review

The authors develop their own review method; they have the same few references as we did in Chapter 3.

A. A big question: We are uncertain about the goodness of the framework (Table 41)
   1. Is the philosophical basis for the framework strong?
      The authors write that

> The concept of TK was originally formulated and discussed in the 20th century philosophy. (Hadjimichael and Tsoukas 2019, p. 674)

The two philosophers Hadjimichael and Tsoukas cite the most when they discuss TK are Ryle (1949) and Polanyi (1958, 1966b). In the Introduction section the authors state that studies published in books should be read (Collins 2010; Nonaka and Takeuchi 1995; Polanyi 1958, 1966b; Ryle 1949; Tsoukas 2011). We found three central philosophical articles suitable for information systems: Chua (1986), mainstream, interpretive and critical perspectives; Mingers et al. (2013), critical realist; and Martela (2015), pragmatist. When Hadjimichael and Tsoukas base their framework on onto-epistemological assumptions, we try to find how ontological and epistemological approaches are characterized. The practice perspective follows a phenomenological onto-epistemology and two others an intellectualist. We are concerned with the latter.

Martela states that:

> Organizational researchers attempting to start an empirical inquiry face an inescapable choice as regards the ontology, epistemology and nature of inquiry underlying their research. As regards these underlying dimensions, the basic choice has often been framed as one between a positivistic and modern research frameworks on the one hand, and more interpretive and postmodern frameworks on the other hand (see e.g. Chia, 1995; Hatch & Cunliffe, 2006). To highly generalize, in positivism the ontological assumption about there being one objective reality and the epistemological belief in the ability of sciences to capture something about this reality have contributed to an attitude of inquiry that seeks out 'general theories about organizations and their members, which are reminiscent of the powerful universal laws found in the natural sciences' (Donaldson, 2003, p. 41). In recent decades, this attitude has been increasingly challenged (e.g. Chia, 1995) from a perspective that is based on a more constructivist ontology and interpretivist epistemology and that accordingly emphasizes the 'practitioners' lived experiences' (Tsoukas & Knudsen, 2003, p. 11). (Martela 2015, pp. 537-538)

We repeat that Chua (1986) defines ontology in the mainstream perspective as "empirical reality is objective and external to the subject. Human beings are

characterized as passive objects; not seen as makers of social reality." and epistemology is "[t]heory is separate from observations that may be used to verify or falsify a theory." Explicit knowledge follows Chua's onto-epistemological assumptions, but tacit knowledge does not. The latter seems to require critical realists' assumptions. Thus, Hadjimichael and Tsoukas' (2019) onto-epistemological assumptions may be slightly incorrect.

2. The framework seems to be a research result, but how good is it?
   As we repeat, the authors say to read studies published in books (Collins 2010; Nonaka and Takeuchi 1995; Polanyi 1958, 1966b; Ryle 1949; Tsoukas 2011). We conclude that the framework (Table 41) is for reviewing studies. According to Okoli (2012), a systematic literature review may have one of three specific goals: theory landscaping, theory building or theory testing. In the Hadjimichael and Tsoukas (2019) article, the goal seems to be theory landscaping. The framework seems to be a lens through which studies are considered. It seems to be a result, but the authors do not emphasize it. They emphasize studies' commonalities and differences between the three perspectives identified.

B. Minor problems
   1. The authors extend the range of their review including studies at the individual and the collective levels of analysis, but they do not remember that multilevel consideration brings some challenges (Burton-Jones and Gallivan 2007)
   2. The authors say to use the ISI Web of knowledge, thus only one article database. Kitchenham et al. (2009) prefer four or more databases.
   3. The list of 17 leading journals contains only *MISQ* from the AIS Basket of Eight journals. Perhaps the authors emphasize "management" and the other seven basket journals did not have the term "management" in the journal title.
   4. The authors identify studies that had the key words "tacit knowledge" and its synonyms (i.e., know-how, procedural knowledge and implicit knowledge). These words or expressions in brackets are not synonyms with tacit knowledge.
   5. The authors state that the Cook and Brown (1999) article is an illustrative example of the interactional perspective. However, Cook and Brown state:

> Furthermore, it is important not to mistake using one form of knowledge as an aid in acquiring the other with one form being "converted" into the other. Tacit knowledge cannot be turned into explicit, nor can explicit knowledge be turned into tacit. (Cook and Brown 1999, p. 385)

This citation is not a merit of the Hadjimichael and Tsoukas (2019) work.

4.9 A short summary

The topics of these eight articles mainly concern socio-technical design, digitalization and dynamic capabilities. The history of IS is almost as long as the history of socio-technical design. Two interested parties, management and employees, with differing values are behind socio-technical information systems. Thus, socio-technical design has been under disputation.

Digital service and digital transformation have been investigated enthusiastically; ordinary and dynamic capabilities are required in modern management. Much is also expected from tacit knowledge in effective management.

The guidelines presented in Chapter 2 are almost forgotten. Only Bozic and Dimovski (2019) use some guidelines from Straub et al. (2004). To our mind, researchers of conceptual studies and/or a conceptual part in these eight articles could utilize Hirschheim's guidelines for conceptual studies (Section 2.6) and thus, improve their work.

The literature reviews presented in Chapter 3 are not followed. Authors are more ready to develop their own literature review method than to use either Levy and Ellis (2006) or Schryen (2015) which we recommend. Researchers seem to know how to write, and/or a reviewer and an editor can easily guide writing, and a reader can easily see it in the examples we present.

The articles analyzed in Chapters 2, 3 and 4 clearly demonstrate that it is necessary to improve researchers' and reviewers' expertise in IS research and its evaluation. Guidelines for methdologies and some complementary guides are intended for these purposes.

5 DISCUSSION/CONCLUSION

In a traditional study, the Discussion/conclusion section is structured as follows: implications for theory and practice, limitations and future studies. As this work is purely theoretical and conceptual, the implications for practice will be fewer than the implications for theory, although we know "nothing so practical as a good theory" (Lewin 1945, p. 135). In addition, many limitations can always 'converted' to future studies.

Here, old and new findings are mainly discussed in Chapters 2, 3 and 4 and in their sections. Therefore, results are collected and re-presented here. They are expressed in Table 43 and structured by sections.

Table 43 Results in Section 2.1 ... Section 4.8

Section	Result
2.1 Positivist case studies Benbasat et al. (1987)	The term "guideline" is in the title and the abstract but not in a text
2.2 Positivist studies Straub et al. (1994)	The authors use the term "standard" for factors when they analyze guidelines by means of factor analysis; 4 factors obtained are named, but we are doubtful whether a reader understand a name of factor in the same way as authors.
2.3 Interpretive in-depth case study and interpretive field study Klein and Myers (1999)	Rather good 7 guidelines; we proposed the eight one: The Principle of Communication. It is hoped that a communication between a researcher and a practitioner should be successful. Klein and Myers (1999) state that action research (AR) can be positivist, interpretive or critical; to our mind, it is more important that AR studies what is a utility of a new system than is a perspective selected positivist, interpretive or critical.
2.4 Design science Hevner at al. (2004)	March and Smith (1995) and Hevner et al. (2004) presented a technological innovation. Liedtka (2020) presented many social innovations that, maybe, can be combined with technical ones.
2.5 Canonical action research (CAR) Davison et al. (2004, 2012)	Action research and design research are similar. IT and an improvement in its use in Chinese cases helped knowledge sharing. Davison et al. were first to use theory in CAR. We see that a differentiation between focal and instrumental theories seems to cor-

	respond a differentiation between truth and utility. A focal theory will describe a continuous action in the intial and goal states, an instrumental theory a change (it happens once) from the initial state to the goal state. We doubt whether an instrumental theory is needed.
2.6 Conceptual research Hirschheim (2008)	We prefer (but Hirschheim does not use) a differentiation: a) a theory, model or framework can be built by deriving from theoretical assumptions or b) by combining results of earlier researches on the same domain.
2.7 Grounded theory (GT) studies Urquart et al. (2010)	The authors introduce five guidelines (1 Constant comparison, 2 Iterative conceptualization, 3 Theoretical sampling, 4 Scaling up and 5 Theoretical integration.) The two last ones put an emphasis on generalization but then, an intesive touch on an object under study, that is typical for GT, will be lost
2.8 Critical research Myers and Klein (2011)	The authors take three researchers (Habermas, Bourdieu and Foucault) on whose studies the six principles are based. We regret that Myers did not accept Engeström's cultural-historical activity theory as a critical theory.
2.9 Mixed methods Venkatesh et al. (2013, 2016)	The authors (2013) stress (1) appropriateness, (2) meta-inferences and (3) validation, and derive four general and five validation guidelines that are (2016) mapped to 22 properties. Mixed methods research has been termed the third methodological movement (perhaps wronly stated as paradigm), with quantitative and qualitative methods.
2.10 Summary of approaches	Sets of guidelines can be shown to associate with research methods. Hence, after determining a suitable method, a researcher will have a set of guidelines fitting with it. Guidelines for mathematical and philosophical approaches are lacking.
2.11 Writing	In Ojala and Lehner (2018), most of guides are good. The abstraction is lacking. The introduction and the discussion section can be structured in other way, too.
3.1 Methodology for developing a literature review (LR)	Levy and Ellis (2006) and Schryen (2015) were selected good guidelines for LR, when reviewed studies are seeking truth not utility, to our mind, also a part of design science (DS) and action research (AR) studies where focal theories is then used. However, a part of DS and AR studies concerning utility is rarely included into LR because of many different utility measures.
3.2 Facilitation of the development of a literature review by classification	In the IS literature, there is asserted: "The latter (prescription) is a special case of prediction". We show that the citation above is not true. Classification trials for LRs seem to be promising but not yet usable.
3.3 One of the many uses of a literature review	Synthetizing seems to build new knowledge from literature reviews. It is possible to conduct gap-spotting in existing literature, and we have ideas for doing the same for "nonexistent ones" (class, relation, dimension; you can consider a gender orientation as an example).
4.1 Saunila et al. (2019)	To our mind, the authors have many difficulties with methodology (e.g., not case study but AR), and literature review.
4.2 Bozic and Dimovski (2019)	The authors conduct their model building and testing in their own way. Literature review is performed via concept after concept.
4.3 Passmore et al. (2019)	The authors write almost as business consultants. To our mind, referring to a literature has many bugs. There is no literature review.

4.4 Swanson (2019)	Minor weaknesses in a conceptual analysis and literature review.
4.5 Li and Chan (2019)	There are at least two views or citations that we think demonstrate the authors might not have mastered their domain: Li and Chan develop their own literature review method. We are afraid that there are problems that the authors did not report.
4.6 Sarker et al. (2019)	Sarker et al.'s proposal of the socio-technical perspective for an axis of cohesion is not the first. But it is still important. In a literature review, there might be some weaknesses.
4.7 Vial (2019)	The expression "value creation" means that Vial explores utility. But to our mind, the author does not specify how utility is measured. Vial conducted a literature review by using a grounded theory (GT) and by performing open, axial and selective coding. Then, a researcher (Vial) gives names for upper categories. We warn whether a reader exactly understand Vial's names. In Table 40, there can also be other works that should not belong to the material of Vial's literature review.
4.8 Hadjimichael and Tsoukas (2019)	To our mind, explicit knowledge follows Chua's (1986) onto-epistemological assumptions, but tacit knowledge does not. The latter seems to require critical realists' assumptions. Thus, Hadjimichael and Tsoukas' (2019) onto-epistemological assumptions may be slightly incorrect.

Implications for theory

We collect recommendations in ten sentences from the other chapters, mostly from Chapter 4. We do not assign an author name to a certain recommendation. However, a careful reader can find his or her article from this work. We hope that these recommendations, which are generally known, can improve researchers', reviewers' and editors' work. Then we emphasize our structure for the guidelines.

We find that a number of fake news is increased. Many reports are not sufficiently argued. We really have a need for good scientific studies. We see that recommendations below, guidelines (Section 2.1 ... Section 2.9) and our guides for literature reviews and writing in this book are intended to achieve a higher ambition level of scientific studies than this far.

Recommendations

1. Read your draft five times before you send it to other people.
2. Do not trust the title, abstract, introduction or discussion section of an article. Read the whole article and try to understand it before you use and refer to it.
3. Although you read a refereed article, remember that it can contain misprints and /or errors. When you read a text that is not refereed (e.g., editorial and/or an introduction to a special number/issue), remember that it is not really re-checked and can contain misprints and/or errors.
4. Use the best possible thinking tools in your research work.
5. All the terms in a title are normally defined in the text.

6. Try to avoid a term (and expression) that has many meanings, for example, critical, quality (Reeves and Bednar 1994), information system, positivism (Siponen and Tsohou (2018), workaround (Ejnefjäll and Ågerfalk 2019), theoretical lens (Niederman and March 2019), sensitizing device (Peppard 2018), IT artifact (Alter 2015) etc. If you must use such a term, define it at the beginning of your text or when it is first needed, and use one meaning of this term (expression) consistently throughout the paper.
7. Use (if possible) a definition in the domain's basic book or in the "must read" article.
8. When you conduct gap-spotting, do it in existing and "nonexistent" literature. For example, a gender orientation is classified: female and male (existing) or homosexual, lesbian and transsexual (nonexistent).
9. Try to find a correct research methodology for your study.
10. A researcher occasionally names factors, variables, states etc.. But s/he must conduct it in such a way that a reader, a reviewer and an editor understand named objects likewise as a researcher?

In summary, some recommendations, e.g., 1, 2 and 3, are taken for granted, but despite that, in journals (and books) there are mistakes that can be much diminished. In our recommendations, there is also advice for expressing things first instead of correcting them later. We showed how a certain mistake without correction can live a long time.

Methodologies structuring guidelines

As far as we know, the set of guidelines presented here is the largest, and it covers the most important methodologies and methods. While these guidelines previously were taken for granted, we critically evaluated each one and showed possibilities for improving them. Every type of methodology does not have an updated set of guidelines, but it must be taken into account in future studies.

We repeat that positivist case studies and other positivist studies need their own new guidelines soon. A reason is that, according to Chen and Hirschheim (2004), positivist research dominates with 81 % of published empirical research.

The guidelines for in-depth case and interpretive studies, design and action research, conceptual, grounded theory studies and critical studies are a good starting point for further development. Consideration of guidelines for mixed methods well supplement an analysis of positivist studies in this respect.

We slightly developed or crystallized some common features of design science and action research. But design science and action research also have several small differences: a) Generally, researchers start design science research, but b) in action research, practitioners play a notable role. According to Hevner et al. (2004), design research is more technologically oriented. Whereas action research is more socially oriented.

Literature review

We recommend two articles, Levy and Ellis (2006) and Schryen (2015), for conducting literature reviews. They cover more important aspects than other literature review methods. Classification for different types of literature review is needed. However, this far, we cannot see much success. We also found some ideas to improve gap-spotting.

Writing

Ojala and Lehner (2018) nicely collected main ideas for how to write a scientific article. We had only minor proposals (structuring of the introduction and discussion sections).

Implications for practice

The articles in Chapter 2 concerning guidelines are intended especially for scholars. However, well-presented papers are understood by practitioners, too. All the papers referred to in Chapter 3 (literature reviews) are intended for scientists and practitioners. The eight papers in Chapter 4 almost always contain the subsection "implications for practice" and are nicely written.

Limitations

There are eight new articles in the spot-check group. Perhaps additional articles could give more misprints and errors from that we could learn more. We hope that these examples and articles for Chapters 2, and 3, all together provide a more concrete view how many different small and/or big mistakes and errors a researcher, reviewer and/or editor can make.

Future research

We highly recommend a completely new set of guidelines for positivist studies be developed soon, because such studies are most common in our field (cf. Chen and Hirschheim 2004). A researcher should take Siponen and Tsohou's (2018) results into account.

We also found that some research methodologies that do not refer to reality, e.g., formal languages, algebraic units etc., need guidelines. At the very least, critical realism, a research philosophy, and perhaps others, needs its own set of guidelines.

Finally, the IS community must study itself, i.e., our way to conduct studies and their evaluation (reviewing) have to be studied.

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