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How to Choose an Adequate Research Method?

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Abstract

We appreciate that a researcher performs a study correctly / rightly. She can do it by an adequate research method. Otherwise, her results are wrong. This paper provides a tree-like taxonomy of research methods for choosing an adequate method. In our taxonomy, we present some simple questions. We organize questions so that a researcher can easily and quickly choose an adequate method, or our taxonomy tells that any answer does not exist in the information systems (IS) literature . The questions ask, for example, a concrete or abstract object under study, a stabilized state or a change, theoretical or empirical, etc. Thus, a researcher knows the things asked at the beginning of her study and finds an adequate method. In addition, an overview of research methods helps her to orient herself in the IS field. We finish our article considering implications for science, limitations and future studies.

Keywords

taxonomy of research methods, research perspective, design research, action research

Introduction

Research, also the IS research emphasizes rigor and relevance. According to Straub et al. (2004,p. 380), “rigor in IS research is still one of the critical scientific issues facing the field.” Benbasat and Zmud (1999, p. 5) consider both rigor and relevance: They refer to rigor as “the correct use of methods and analyses appropriate to the tasks at hand” and “IS researchers and the editors of top IS academic journals have tended to emphasize rigor over relevance in their journals.” To emphasize relevance, Benbasat and Zmud want most IS researchers to have close contact with practice. These two views and especially rigor firmly support our goal to choose an adequate IS research method.

We show that IS researchers rarely consider this topic (choosing an adequate method) with two examples. The article by Gonzalez and Dahanayke (2007) is best for topic and purpose. They developed some parts of a framework for analyzing and choosing an adequate method. We want to continue their analysis and assume that the IS researchers do not yet have adequate methods. An idea is to develop some simple and easy research questions for choosing an adequate method.

Gonzalez and Dahanayke (2007) wrote one of few papers on the IS research methodology. They present “a simple concept map of the wide and diverse spectrum of information system (IS) research approaches, focusing on helping researchers to have an overview of what these approaches are, what they are grounded on and what methods are available for them. It considers research philosophy, methodology, and method” (p. 846). Gonzalez and Dahanayke (2007) consider the three research philosophies: Positivist, interpretive and critical approaches. Three research philosophies seem to be based on Chua (1986) and Orlikowski and Baroudi (1991). We shall later evaluate and supplement those three research philosophies. But now we are more interested in methodologies.

Gonzalez and Dahanayke (2007) present four IS research methodology typologies: 1. quantitative vs. qualitative, 2. empirical vs. non-empirical, 3. design science vs. behavioural science, and 4. multi-methodology. Each one of the four methodologies almost covers a similar domain of methods. We shortly analyze each one.

Two first divisions (quantitative vs. qualitative, empirical vs. non-empirical) seem to cover all the methods. These two divisions into two pairs assume that an object under study has achieved a stable state (Hann and Weber 1996). It means that researchers ignore objects with assumptions rather than a stabilized state. But Salo et al. (2022) show that the forming and mitigating processes of (techno)stress exist. These stress processes are not in a stable state. However, they represent a reality and often are objects under study.

Mingers (2001) proposed a multi-methodology where different methodologies are combined, but it is not often possible because assumptions of different methodologies differ. The Mingers’ idea of multi-methodology is interesting, but we do not study it more thoroughly here.

Gonzalez and Dahanayke (2007) analyze IS research methods, too. They define (p. 847) ”The research method is understood here as more specific than a methodology: it is the systematic approach to the inquiry which implies skills, assumptions and practices as the bridge, so to speak, between the methodology and the actual design of the research.” They concretize their task by presenting three properties: duration, researcher-subject relationship and ”design” (maybe a practical preparation and realization) of a study. We are developing a taxonomy of groups of similar research methods. Hence, we are not considering methods similar to Gonzalez and Dahanayke (2007).

Salo et al. (2022, p- 1073) describe that “Understanding information technology (IT) use is vital for the information systems (IS) discipline due to its substantial positive and negative consequences. In recent years, IT use for personal purposes has grown rapidly. Although personal use is voluntary and can often reflect fun, technostress is a common negative consequence of such use. When left unaddressed, technostress can cause serious harm to IT users. However, prior research has not explained how technostress forms over time or how its mitigation takes place in a personal—rather than organizational—environment.” Based on above, the authors formed two research questions:
(1) How does technostress form in the personal use of IT?
(2) How can users change their IT use practices to mitigate technostress?

Salo et al. (2022, p. 1078) “chose to conduct a qualitative study with real-life narratives (Myers, 1997)” for **a**nswering their research questions required rich data about how technostress develops

and how users mitigate it by changing their IT use practices over time. The authors deemed their approach appropriate due to its usefulness in explaining how things change.” Salo et al. (2022, p. 1079) ”collected narratives by interviews and analyzed them by iterating between our data and the literature on (techno)stress.” The authors believed they tried to find explanations for the previously unmapped topic.

Two research questions tell that Salo et al. (2022) study two change processes to form / develop and mitigate (techno)stress. Burrell and Morgan (1979) have long had an extent influnce on research methods. They have assumed a stabilized state (status quo) of the object of study. But here, the research objects were two change processes. We are unsure whether there is any known method for a change process.

The problematic two examples (Gonzalez and Dahanayke 2007, Salo et al. 2022) above demonstrate that researchers must know as many different methods as possible. Chen and Hirschheim (2004) performed a literature review (LR) in journals between 1991 and 2001 and trusted that authors of journal papers had correctly named the used research method. The number of journal papers was 1893. Chen and Hirschheim (2004) did not find any critical one. Richardson and Robinson (2007, p. 258) repeated a similar LR and "found a small number of critical papers (13) appearing in the journals examined by Chen and Hirschheim between 1991 and 2001." We understand that Richardson and Robinson (2007) had the same sample from where they found few critical studies. Chen and Hirchheim (2004) could not identify any critical research paper from their sample. This difference is a new example of how authors of the original 1983 papers and four researchers did not understand a research method similarly.

Gonzalez and Dahanayke (2007) felt “that the division between design science vs behavioural science is not general enough to be taken as the opposing poles for IS research (technical versus social, in this case).” To our mind, the division between design science (DS) vs behavioral science is important and sometimes also difficult for IS researchers. According to Hevner et al. (2004, p. 98), “the design-science research paradigm is proactive with respect to technology. ... The behavioral-science research paradigm is reactive with respect to technology in the sense that it takes technology as given.”The division between DS and behavioural science is essential for developing our taxonomy of research methods because assumptions behind behavioural science and design science are different: (a stabilized state) status quo and a change, respectively. Jarvinen (2007) and later Lee and Hubona (2009) described that DS and action research (AR) are similar. Researchers use DS and AR methods in building / developing a change in a system. Hence in the next section and before the development of our taxonomy, we more deeply analyze assumptions of the change paradigm.

After, we apply a top-down approach to constructing and developing a taxonomy. In this process, we divide each step into two pairwise disjoint alternatives and present a justification for the differentiation. We describe our taxonomy both verbally and pictorially. Pictorially, we explain our taxonomy in four figures. Fig. 1: An overview of research methods. Fig. 2: Research methods in the stabilized state case. Fig. 3: Research methods in the change case, Fig. 4: Analyzing studies with two-dimensional relationships. Finally, we summarize our results, present limitations and future research.

The change paradigm

Burrell and Morgan (1979) presented two types of assumptions about knowledge (epistemological) and the world (ontological) for yielding two dimensions: a subjectivist-objectivist dimension and an order-radical change dimension. The dimensions when mapped onto one another yield four paradigms (see Table 1): functionalism (objective-order); interpretivism (subjective-order); radical structuralism (objective-radical change); and radical humanism (subjective-radical change).

Table 1. Four paradigms in Burrell and Morgan (1979)

	Subjective	Objective
Radical change	Radical humanist	Radical structuralist
Order	Interpretive	Functionalist

When a reader looks at the four paradigms in Table 1, they seem to cover wholeness. We must then ask: Are there some activities outside Table 1? Orlikowski and Baroudi (1991) write that functionalism (positivism) and interpretivism assume status-quo, i. e. a stabilized state. In Table 1, there are two radical change paradigms. We can now ask: Are in the world such changes that are not radical but shared, desired together? In reality, there are some poor actions in an organization that all like to change or to improve, in other words, to solve this problem. In addition, we perform building and maintenance tasks in the IS system. Then IS experts build a new part of the system or maintain an old one. In both cases, the IS experts change the IS system from the initial state to the goal/final state. When experts apply scientific procedures, an approach is called action research.

In education, teachers' teaching intends to help learners' learning, and hopefully, this teacher's effort causes a desired change in learners' knowledge structure. In social work, experts' actions hopefully lead to customers' change processes. Hence, education and social work are similar desired change processes. But in the world, there are two paradigms, positivism and interpretivism, also called by Hevner et al. (2004) the behavioural-science paradigm that seeks to create "what is true". Hevner et al. (2004, p. 98) continue " In contrast, the design-science paradigm seeks to create what is effective." In other words, in positivism and interpretivism a criterion is *truth* in the design-science paradigm (here called the *change paradigm*) effectiveness and/or *utility* (March and Smith 1995, Hevner et al. 2004) are considered as a goodness of study.

A taxonomy for choosing an adequate research method

In this section, we start with all research methods and divide them into two classes. We continue by dividing those two classes into sub-classes, by dividing them again … . A classification plays a central role and it must be good. Bunge (1967, 75) has defined and described three principles of a good classification: "One of the principles is that the characters or properties chosen for performing the grouping should stuck to throughout the work. Another rule of correct classification is that the subsets of the same hierarchical rank should be exhaustive and pairwise disjoint, i.e. should jointly cover the whole field and should have no members in common. The third rule is not logical but a methodological one, namely, the various classifications of one and the same universe of discourse should be coincident (as regards the extensions) if they are to be natural rather than artificial groupings." Properties of a good classification are: a) A dividing factor remains permanent, b) A classification is exhaustive, c) pairwise disjoint and d) natural. In this work, we use Property b) (exhaustive) and Property c) (pairwise disjoint).

Our taxonomy has a tree-like form. We group similar methods into a branch of a tree. We describe a taxonomy verbally and pictorially. Our first picture (Figure 1) presents an overview of research methods in IS studies. We develop our taxonomy by stating questions. For example, is your object under study a part of reality? We start with this question and assume that a researcher has formed her research question and she can answer this question. A researcher can continue from the overview picture to the other three pictures. In addition to divisions, a sequence of questions is also remarkable, and we clarify it in connection with a particular branch. - In every tree-like figure, a tree branch presents one or a group of similar methods or "other n". The final tree branch (we do not divide it further) is underlined and bold.

An overview of research methods.

We start with the question: Is your object of study a part of reality? This question has two answers: yes (your object is a part of reality) and no. In the IS research literature, there is no jointly accepted method for the latter. We name this case with "other 1". It means something like mathematics and philosophy. They do not have any correspondence to a part of reality.

In our decision tree (Figure 1), we then state a question: Is your object of the study totally observable? Almost all IS studies have thus far had a totally observable object of study. Bhaskar (1978) in behavioural sciences and Mingers et al. (2013) in IS studies have considered partially observable studies and their philosophy of science (critical realism, CR). Bhaskar (1978) outlines what he calls three domains: the real, the actual, and the empirical. Mingers et al. (2013) inform that the real contains mechanisms, events, and experiences (i.e., the whole of reality); the actual consists of events that do (or perhaps do not) occur and includes the empirical, those events that are observed or experienced.

Domains the real and the actual can have mechanisms and events that are at least partially unobservable. Okoli (2012, p. 35) gave an example of a partially observable research object: "skilful devices in the form of a diverse host of synthesis techniques are needed to siphon the "subterranean water"—the real causes—that germinate the seeds—the actual events—that are visible as "plants"—the empirical observations." - As much as we know, CR does not have any specialized method.

We propose first the question: Is your object of the study totally observable? The second question: Does your object of study have a one- or two-directional relationship? As we told earlier, a sequence is remarkable, and we now can analyze and separate (partially unobservable) CR studies from other studies concerning a part of reality.

We then divide the rest of our studies into two parts depending on whether the studies under analysis have one-dimensional relationships or two-dimensional ones. The former is the most general, and we divide those methods whether the methods assume either a stabilized state (status quo) (Figure 2) or a change (Figure 3). We analyze methods in studies where there are two-dimensional relationships in Figure 4.

Analysis of research methods at the top level

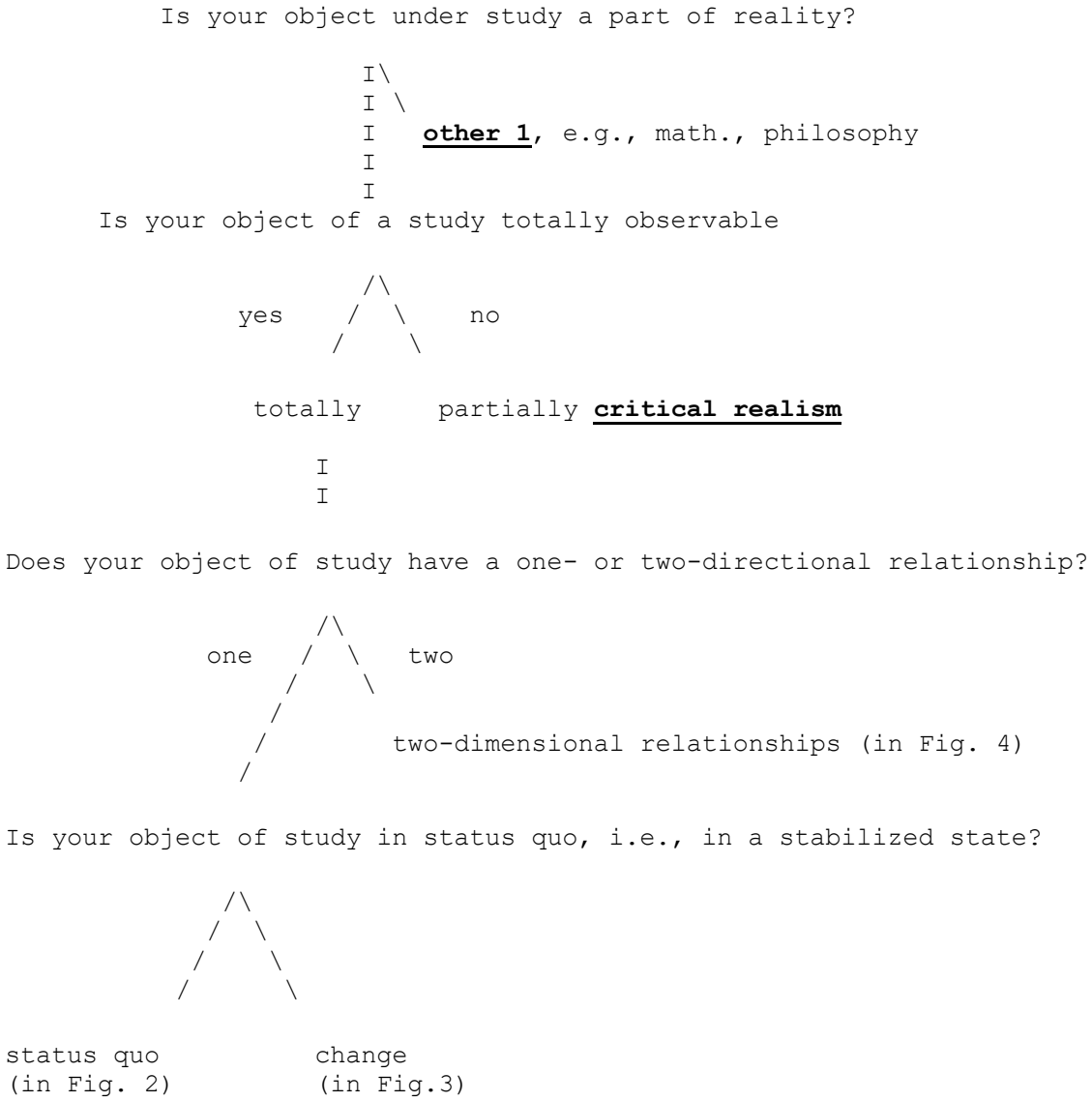

Figure 1. The first part of the taxonomy for choosing an adequate research method.

Analysis of research methods in the stabilized state case

In the stabilized state (status quo) assuming method group (Figure 2), we call research methods traditional. Studies can be either theoretical or empirical. Therefore, we state a question: "Is your study empirical?". If the answer is no, you select a conceptual-theoretical method. In IS studies, such a conceptual-theoretical method is, for example, conceptual modelling, e.g., Wand and Weber (2002) and Recker et al. (2021). The example above describes an approach starting from axioms. Another approach uses previous studies and produces a literature survey of a particular problem domain.

Next (your study is empirical), we are asking: Do you test a theory, model or framework? The answers to this question are ”theory-testing” and ”theory-creating”. We consider that a theory, a model and a framework are similar enough when a researcher is studying a part of reality and assuming a stabilized state.

An analysis of traditional methods

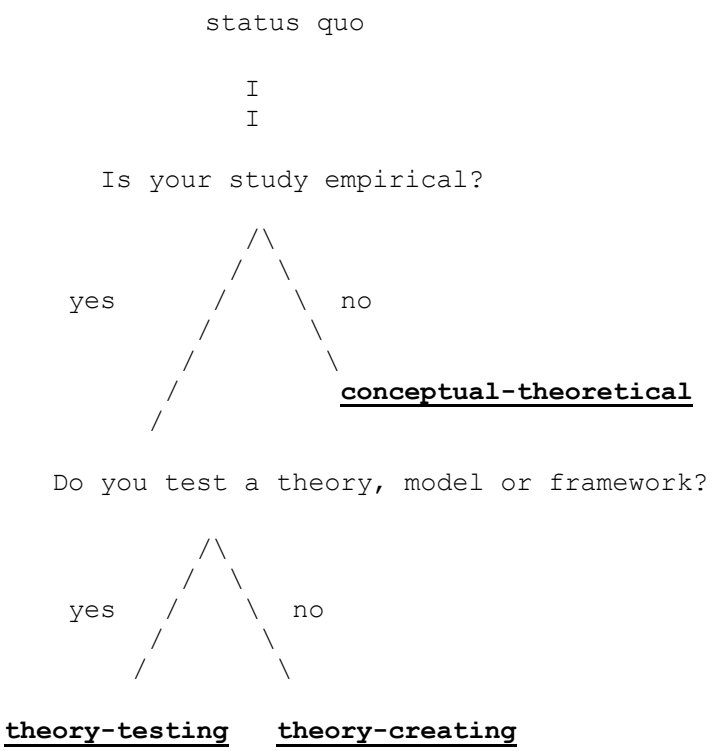

Figure 2. Research methods in the stabilized state case.

The theory-testing approach perhaps is the most popular in IS studies. We then have such methods as experiments (laboratory, randomized field, natural – see Karahanna et al. 2018) and surveys. Grounded Theory (GT) (Glaser and Strauss 1967, Urquart et al. 2010) and case studies (Benbasat et al. 1987, Eisenhardt 1989) are example methods for theory-creating studies.

Analysis of research methods in the change case (DS, AR)

For the change alternative (Figure 3), there is a question: "Is a measurement of goodness in your study utility?" To characterize more design science (DS), we cite Hevner et al. (2004, p. 81) "design-science research is differentiating routine design or system building from design research. ... design-science research addresses important unsolved problems in unique or innovative ways or solved problems in more effective or efficient ways." The citation above means that utility is a measurement of DS, i.e., goodness in problem-solving or taking advantage of opportunity. The

same is valid for action research (AR), as well. In Fig. 3, there is a question for DS and AR methods: ”Is an object of study IT?

If the goal of your study is not utility, our taxonomy refers to another research approach, where is a branch called other 2 that a researcher does not yet know. We repeat this by recommending that IS researchers find a new research method in further studies below.

An analysis of change-realizing methods

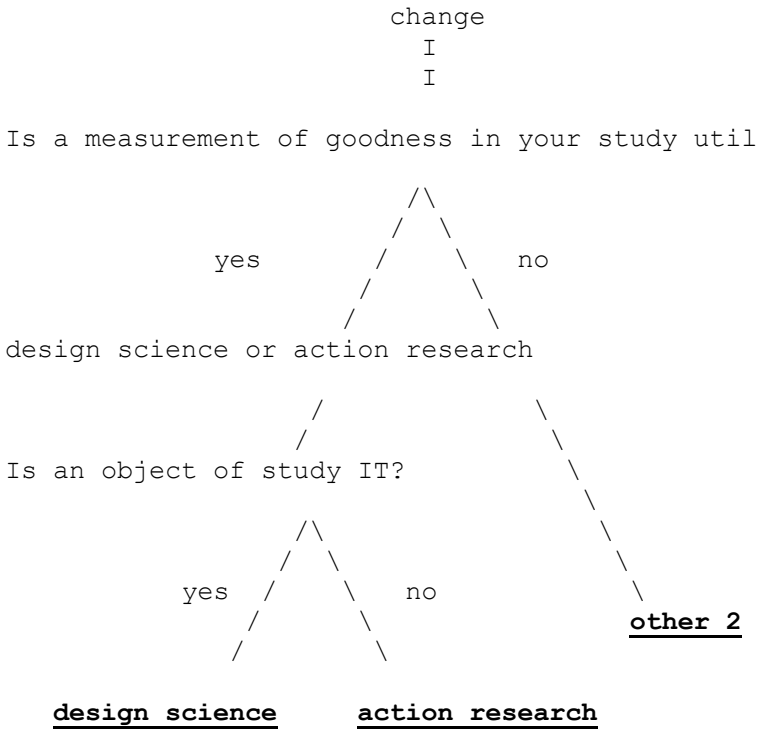

Figure 3. Research methods in the change case

DS methods often are in software engineering literature, e.g., XP and Scrum. Sein et al. (2001) developed the ADR (action design research) method for IS development. However, we recommend using ADR for building an IT artifact. A reason is that users and practitioners evaluate the IT artifact in use. But they do not tell which criterion they have for measuring its goodness in use. Baskerville and Wood-Harper (1998) presented that 10 ISD methods are also AR methods, and Davison et al. (2021) presented some more. We know that researchers have many similar AR methods, not only one. AR studies in the IS literature concern all resources (technical, social and informational). Previously, AR studies concerned social resources only, for example, Susman and Evered (1978).

In Figures 2 and 3, we suppose that a researcher assumes one-directional relationships in her study. Such studies cover most parts of IS studies. Next, we briefly analyze two-dimensional relationships in IS studies.

Two-dimensional relationships in IS research

We first refer to Chua (1986) and Orlikowski and Baroudi (1991) for characterizing critical research. To our mind, the latter does not bring anything new for Chua (1986). But Orlikowski and Baroudi (1991, p. 18-19) express it better: "An important distinction of the critical research philosophy is its evaluative dimension. More than the positivist or interpretive research perspectives, the critical researcher attempts to critically evaluate and transform the social reality under investigation. Where the other two research perspectives are content to predict or explain the status quo, the critical perspective is concerned with critiquing existing social systems and revealing any contradictions and conflicts that may inhere within their structures. Through fostering this type of self-consciousness and understanding of existing social conditions, critical researchers believe they can help to overcome oppressive social relations." From the citation above, we take the first question in Figure 4: Are there contradictions and conflicts in the structures of your object of study?

Analysis of two-dimensional relationships in studies

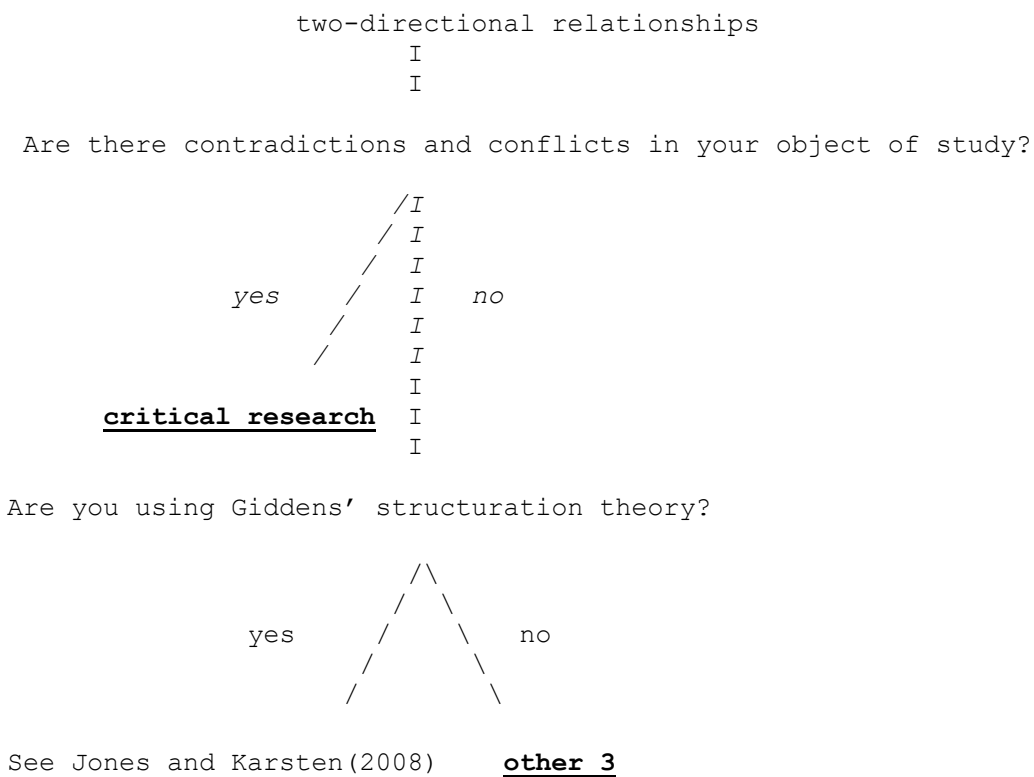

Figure 4 Analyzing studies with two-dimensional relationships.

To make critical research concrete, we continue to cite Orlikowski and Baroudi (1991,p. 19): "An important objective of critical research is to create awareness and understanding of the various forms of social domination so that people can act to eliminate them." Hence, awareness of a problematic situation is already a result of the critical research study. We also emphasize critical

research's evaluative aspect. To this end, critical research is not value-free. People try then to change the current situation.

If you are not performing critical research, in Figure 4, there is a possibility to apply Giddens' Structuration theory. If a reader is interested in this topic, we inform you that Jones and Karsten (2008) made a critical review of the work of Giddens and its application in the IS field. - We also refer in Figure 4 to another type of IS study by the label "other 3". It means that there are research projects with two-dimensional relationships assumed, and anybody has not yet developed any research method. We earlier referred to Salo et al. (2022). They studied two opposite (techno) stress change projects, forming and mitigating. In the IS literature, one has not developed a research method thus far for these change projects.

In Figures 1, 2, 3 and 4, we have applied a dividing method to a unit under question that gives two alternatives that cover the whole unit. Two options are exhaustive and pairwise disjoint that Bunge (1967) demands from the good classification.

Discussion

We divide this section into three parts: implications to science, limitations and future studies.

Implications for science

Our taxonomy (in Figures 1, 2, 3 and 4) provides a quick way to choose an adequate research method. It also shows where a researcher can and must enlarge our taxonomy. Very little knowledge about a phenomenon under study and its environment is required when a researcher applies our taxonomy. A path from the beginning (from the question: What is your phenomenon under study?) to the underlined branch shows assumptions describing a method or a set of similar ones. Our advantage is that assumptions in our taxonomy are explicit (not implicit as often).

Figure 1 shows IS research as an overview picture in the methodological sense. Avgerou (2000) tried to develop a similar view based on the contents of IS articles.

Limitations

Our presentation has some deficiencies. First, Jones and Karsten (2008) reviewed applications of the structuration theory (Giddens 1984) in IS. They demonstrated how Giddens did not keep assumptions of positivism and interpretivism entirely correct in sociology. Hence, Jones and Karsten (2008, p. 131) stated: "Structuration, therefore, sought to avoid such asymmetrical and dualistic treatment of action and structure by conceptualizing the two as a mutually constitutive duality." We see that in Chua's (1986) paper, two perspectives (positivism and interpretivism) assume a one-dimensional (→) causal relationship between two variables, but critical research two-dimensional (→ ←) relationships (often between a realm of human action and an institutional realm). Researchers must later analyze this differentiation of two types (one- and two-dimensional) relationships more thoroughly. In the same connection, researchers must also analyze applications of the structuration theory (Giddens 1984) in IS.

Second, Benbasat et al. (1987) demonstrated that the case study method is not always exploratory (theory-creating) but also confirmatory (theory-testing), but rarely. They write (p. 378): "Some case studies pursued an explanatory strategy by first describing the events that took place and then presenting multiple competing theories to explain the course of events." We do not consider this a

limitation, but a researcher must be careful when she uses the case study method whether she uses it for either exploratory or confirmatory purposes.

Third, especially design science, action research and critical research stressed the need for change. But which kind of a need and how to measure a change? March and Smith (1995, p. 260) said: “Research in the building activity should be judged based on value or utility to a community of users." Hevner et al. (2004, p. 85) wrote: "Business organizations are goal-oriented entities existing in an economic and social setting. Economic theory often portrays the goals of business organizations as being related to profit (utility) maximization." Hence, design science emphasizes utility to a community of users or to a business organization. Action research pays attention to solving a problem and also to problem owners. Utility may be an adequate measurement of goodness in problem-solving and organizational development. Critical research provides invaluable insights into and critiques of power, politics, oppression, and domination in action, e.g., in IS development and use, as well as advocates the empowerment of the oppressed. Critical research strives to make people understand their problematic situation and its need to change. It can guide a change according to the will of the oppressed. Hence, the goodness of a solution is not always explicitly stated at the beginning of the study, but a researcher must clarify it.

Future studies

Limitations 1 and 3 above can be "converted" to new studies, i.e., a researcher can develop a new set of perspectives to describe social science and society better, e.g., Giddens (1984); researchers can develop our taxonomy by trying to find better-differentiating factors.

Tree-like Figures 1, 3 and 4 show three unsolved "branches" (other n) that any proposed method does not exist. Researchers must develop them in the future.

Conclusion

Our taxonomy is better than the best one (March & Smith 1995). It is quick and pays attention to the essential characteristics of a study. Although our taxonomy sometimes finds a set of adequate methods (instead of a single one), a researcher will make a small mistake but find a qualified one.

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