Delphi Method Variants in Information Systems Research: Taxonomy Development and Application

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Abstract: Delphi is a frequently used research method in the information systems (IS) field. The last fifteen years have seen many variants of the Delphi Method proposed and used in IS research. However, these variants do not seem to be properly derived; while all variants share certain characteristics, their reasoning for differentiation inconsistently varies. It seems that researchers tend to create "new" Delphi Method variants, although the underlying modification of the Delphi Method is, in fact, minor. This leads to a heterogeneity of Delphi Method variants and undermines scientific rigor when using Delphi. The study addresses this deficit and (1) identifies different variants of Delphi and determines their characteristics, (2) critically reflects to what extent a clear distinction between these variants exists, (3) shows the clearly distinguishable Delphi Method variants and their characteristics, (4) develops a proposed taxonomy of Delphi Method variants, and (5) evaluates and applies this taxonomy. The proposed taxonomy helps clearly differentiate Delphi Method variants and enhances methodological rigor when using the Delphi Method.

Keywords: Delphi, Delphi method characteristics, Delphi method variants, Information systems research, Taxonomy, Taxonomy development.

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1. Introduction

Delphi is a method used to examine a complex problem through a group of experts. Experts are chosen as a data source in Delphi because of their special knowledge and experience regarding the issue under investigation. The experts provide data through questionnaires over several iterations. After each iteration, controlled feedback with the anonymized consolidated responses is provided to all participants. Consequently, experts can reflect and revise their opinions and judgements for the next iteration. The process stops when the research questions are answered. This may, for instance, be the case when consensus is reached, theoretical saturation is achieved, or sufficient information has been exchanged (Skulmoski, Hartman and Krahn, 2007; Linstone and Turoff, 1975; Delbecq, van de Ven and Gustafson, 1975).

The Delphi Method was first described in 1963 by Dalkey and Helmer, who conducted a Delphi study at the RAND corporation to apply expert opinions to a military problem. Over the years, Delphi has been applied in many research areas such as business, education, healthcare, and IS (Gupta and Clarke, 1996; Mitchell, 1991; Gallego and Bueno, 2014). The number of studies in the IS field using the Delphi Method is increasing (Gallego and Bueno, 2014), and Delphi appears to be an established method in IS research (Rowe and Wright, 1999; von der Gracht, 2012; Skulmoski, Hartman and Krahn, 2007; Gray and Hovav, 2008). Studies using the Delphi Method have, e.g., identified key IS management issues (Brancheau, Janz and Wetherbe, 1996), developed a descriptive framework of knowledge manipulation activities (Holsapple and Joshi, 2002), and investigated the IS outsourcing provider selection process (Chang et al., 2012). Although our paper focuses on IS research, we assume that similar observations and conclusions can be drawn in other disciplines that have adopted the method and are increasingly using it.

From a methodological perspective, researchers have proposed many variants of the Delphi Method. Main variants include Classical Delphi (Dalkey and Helmer, 1963), Decision Delphi (Rauch, 1979), Policy Delphi (Linstone and Turoff, 1975), and Ranking-Type Delphi (Delbecq, van de Ven and Gustafson, 1975; Schmidt, 1997). Furthermore, researchers have modified these main variants and proposed sub-variants (Chakravarti et al., 1998; Chang, 2006; Landeta and Barrutia, 2011; Tapio, 2003; Gupta and Clarke, 1996; Paré et al., 2013). While the method's modifiability can be considered as one of its advantages, "there is the danger that too much modification without ensuring rigor may threaten the validity of the original research approach" (McKenna, 1994, p. 1222), which may negatively impact its quality and credibility (Gupta and Clarke, 1996).

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There are suggestions to improve the Delphi Method's rigor (e.g., Gallego and Bueno, 2014; Paré et al., 2013). However, these publications focus on improving the rigor of specific Delphi Method variants but do not contribute to clearing the ambiguity regarding the differentiation and definition of Delphi Method variants. The objective of this research is to address this gap and propose a taxonomy of Delphi Method variants. Thus, our study contributes to enhancing rigor in applying the Delphi Method in IS research. Our corresponding research questions are:

(RQ1) What Delphi Method variants are differentiated in IS research?
(RQ2) To what extent does a clear distinction exist between these variants?
(RQ3) What are clearly distinguishable Delphi Method variants and their characteristics?
(RQ4) How can a taxonomy be set up to clearly differentiate Delphi Method variants?
(RQ5) How can the taxonomy be applied to existing and new research to define Delphi Method variants purposefully and unambiguously?

The paper is organized as follows. Section 2 describes findings related to Delphi Method variants and their characteristics in IS research (RQ1). An analysis of these findings addressing RQ2 and the description of clearly distinguishable Delphi Method variants and their characteristics (RQ3) follows in Section 3 and Section 4. At the end of Section 4, the taxonomy is developed and presented (RQ4). The resulting taxonomy from Section 4 is then evaluated twice (RQ5). In Section 5, we apply it to IS research published in three highly ranked IS journals. In Section 6, we evaluate the practical applicability of the taxonomy by using it to define the specific Delphi design for one of our research projects. Section 7 concludes the study by summarizing research contributions, assessing its limitations, and suggesting potential avenues for future research.

2. Delphi method variants in is research

A systematic literature search was used to identify Delphi Method variants and their characteristics in IS research. The first step addresses the identification of relevant databases. Vom Brocke et al. (2009) recommended searching databases that provide access to leading IS journals. To meet these requirements, the search process included the databases AIS electronic library, EBSCOhost (Business Source Complete), IEEE Xplore, ProQuest, and ScienceDirect. These databases provide access to journal articles and conference papers published in leading IS journals and conferences, according to the IS Senior Scholars Basket of Journals (Association for Information Systems, 2011), the MIS Journal Ranking (Association for Information Systems, 2013), and the most preeminent IS conferences (Association for Information Systems, 2017).

The databases were queried using a keyword-based search with the search string: "Delphi AND Information Technology" and "Delphi AND Information Systems". To obtain as many Delphi Method-based studies as possible, we did not limit the search timeframe. Further settings included a boolean/phrase search mode, choosing the search field "title, keyword, abstract" and restricting results to scholarly peer-reviewed articles (Levy and Ellis, 2006) of more than four pages. We used a subject (thesaurus) filter and classification codes in some databases to exclude non-IS research. Finally, we used a forward-backward search approach (Webster and Watson, 2002) to determine prior articles and identify further articles.

An evaluation of sources ensured that only relevant research articles were included (vom Brocke et al., 2009). Overall, we identified 104 literature items consisting of 85 journal articles, 13 conference papers, and six monographs. These items can be classified into two subgroups: "Delphi Method" (31 journal articles, six monographs, and three conference papers) and "Application of Delphi Research" (54 journal articles and 10 conference papers). Five studies from the 40 studies in the Delphi Method subgroup define and differentiate 13 Delphi Method variants (cf. Table 1). The remaining literature items of this subgroup focus on characteristics of Delphi in general or specific Delphi Method variants that are included in Table 1 (follows).

Table 1: Overview of the heterogeneous classification of Delphi Method variants (reference in each column reflects the primary source for each variant, if identifiable)

Author/ Delphi variant	Classical Delphi (Dalkey and Helmer, 1963)	Policy Delphi (Linstone and Turoff, 1975)	Decision Delphi (Rauch, 1979)	Electronic Delphi (Mitchell, 1991)	Modified Delphi (non-identifiable)	Ranking-Type Delphi (Schmidt, 1997)	Real-Time Delphi (Gordon and Pease, 2006)	Argument Delphi (Kuusi, 1999)	Disaggregative Policy Delphi (Tapio, 2003)	EFTE (Nelms and Porter, 1985)	Mini Delphi (non-identifiable)	Online Delphi (non-identifiable)	Technological Delphi (non-identifiable)
Rauch (1979)	X	X	X										
Mitchell (1991)		X		X						X			
Keeney (2010)	X	X	X	X	X		X	X	X			X	X
Paré et al. (2013)	X	X	X			X							
Gallego et al. (2014)	X				X	X	X				X		
Σ	**4**	**4**	**3**	**2**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1**

Rauch (1979) suggests a distinction between three kinds of Delphi Method variants: Classical Delphi (Dalkey and Helmer, 1963), Policy Delphi (Linstone and Turoff, 1975), and Decision Delphi (Rauch, 1979). He describes Classical Delphi as the "well known-basic Delphi approach […] [seeking] to obtain a group opinion through an anonymous, multilevel group interaction" (Rauch, 1979, p. 160). Classical Delphi serves as a forum for facts to seek a consensus among homogeneous groups of experts. In contrast, Policy Delphi serves as a forum for ideas seeking to generate the strongest possible opposing views. It is a tool for the analysis of policy issues and not an approach for making a decision (Linstone and Turoff, 1975). To prepare and support decisions is the objective of the third variant of Delphi. Facts and ideas are thrust into the background so that Delphi serves as a forum for decisions (Rauch, 1979).

Mitchell (1991) identified further variants. He differentiates an Electronic Delphi that uses information systems or computer simulations to conduct the questionnaire iterations. Furthermore, he characterizes a conversational Delphi, the so-called EFTE (Estimate, Feedback, Talk, Estimate) Delphi (Nelms and Porter, 1985). The special attribute of this variant is direct interaction (face-to-face) with the respondents, which provides immediate feedback but does not try to force a consensus.

The variant Modified Delphi includes a combination of Delphi with another method, for example, scenario writing (Chakravarti et al., 1998). Keeney (2010) describes Modified Delphi as a modification of the Classical Delphi technique, combining it with, e.g., employing a focus group, interviews, or results of a review to develop the first round. In addition, Keeney (2010) characterizes an Electronic, Online, and Technological Delphi, which are all conducted using some form of information technology as well as an Argument (Kuusi, 1999) and Disaggregative Policy (Tapio, 2003) Delphi. While the objective of an Argument Delphi is to develop relevant arguments and expose underlying reasons for different opinions on a specific issue, Disaggregative Policy Delphi constructs future scenarios in which panellists are asked about their probable and preferable future (Hasson and Keeney, 2011). Finally, Keeney (2010) characterizes a Real-Time Delphi (Gordon and Pease, 2006) without distinct questionnaire iterations; expert responses are updated and provided to participants in real time through an information system (Gordon and Pease, 2006).

In addition to the variants of Delphi reviewed above, Paré et al. (2013) further differentiate a Ranking-Type Delphi (Schmidt, 1997). This variant is used to reach a group consensus about the relative importance of issues. To identify and rank key issues, this Delphi Method variant uses an iterative-controlled feedback process that includes the brainstorming, narrowing-down, and ranking process steps (Schmidt, 1997).

Gallego and Bueno (2014) identified a further simplified variant of Delphi, Mini-Delphi. It consists of a physical meeting of experts to conduct individual estimations with a subsequent debate regarding the aggregated answers (Gallego and Bueno, 2014).

In summary, it is apparent that a multitude of Delphi Method variants have been defined and are used in IS research (Paré et al., 2013; Skulmoski, Hartman and Krahn, 2007; Hasson and Keeney, 2011). However, the differentiation criteria seem to be inconsistent, e.g., based on research objective, type of rounds, data-gathering approaches, and facilitating technologies. This raises the question as to what extent a clear distinction between these variants really exists (RQ2).

3. Analysis of delphi method variants

Following Rowe and Wright (1999), as well as Skinner et al. (2015), only those studies that show four generic characteristics should be classified as Delphi studies. These characteristics are:

1. *Anonymity of participants:* Responses from the series of questionnaires are anonymized by the research team. This anonymity allows group participants to express their judgements individually and without social pressure that could arise from dominant individuals. Furthermore, negative influences of individual responses associated with personalities or statuses of the participants can be excluded through anonymized responses.
2. *Controlled feedback:* Controlled feedback is provided between each questionnaire iteration. Each participant is informed about the thoughts of their anonymous fellow participants. The research team deletes all irrelevant information.
3. *Iterative process:* The questionnaire includes a number of iterations. Each iteration constitutes an opportunity for participants to reflect and revise their judgements with the help of the information they receive from the rest of the participating experts.
4. *Statistical aggregation of group response:* All views contribute to form part of the answer after the final round. A quantitative and statistical treatment of these answers can then be carried out.

According to Hasson and Keeney (2011, p. 1698), "Within each Delphi [Method] type, the characteristics of the Delphi can also differ, for example, the number of rounds, the level of anonymity and feedback given, as well as the inclusion criteria, sampling approach or method of analysis".

We use the four generic characteristics for our analysis and refine them based on the specifications of Delbecq, van de Ven and Gustafson (1975) and Kuusi (1999) to develop more detailed and specific characteristics. *Anonymity* subsumes panellist and individual responses. *Controlled feedback* means that information about panellists' answers is fed back to the panellists; this feedback could be provided by a facilitator running the Delphi. An *Iterative process* contains a series of rounds; it uses a questionnaire and gives participants the opportunity to rethink opinions between each iteration. Finally, questions are formulated so that a quantitative and *statistical aggregation* of the answers can be carried out. In addition to these characteristics, we identify the *focus* and *objective* of each Delphi Method variant and attempt to identify its distinctive nature. These characteristics are used to analyse the 13 Delphi Method variants (cf. Table 2, left column).

Table 2: Analytical result according to Delphi Method variants and their characteristics

Characteristics / Delphi variants	Argument Delphi	Classical Delphi	Decision Delphi	Dissaggregative Policy Delphi	EFTE Delphi	Electronic Delphi	Mini Delphi	Modified Delphi	Online Delphi	Policy Delphi	Ranking-Type Delphi	Real-time Delphi	Technological Delphi
Focus	Arguments	Facts	Decisions	Holistic scenarios	Opinion-capture	Un-stated	Un-stated	Vary-ing	Un-stated	Ideas	Ranking issues	Real-time answers	Un-stated
Objective	Develop arguments and expose reasons	Elicit opinion and gain consensus	Prepare and support decisions	Construct holistic scenarios	Opinion capture in multi-disciplinary tasks	Un-stated	Un-stated	Vary-ing	Un-stated	Define and differen-tiate views	Consensus about the relative importance of issues	Improve the speed of Delphi process	Un-stated
Anonymity of participants													
Anonymous responses	X	X	X	X	X	X	X	Un-stated	X	X	X	X	X
Independent Panellist	Partici-pants are known	X	Partici-pants are known	X	Partici-pants are known	X	Partici-pants are known	Un-stated	X	X	X	X	X
Controlled feedback													
Consolidated feedback	X	X	X	X	X	X	X	Un-stated	X	X	X	X	X
Facilitator runs Delphi	X	X	X	X	X	X	Un-stated	Un-stated	X	X	X	X	X
Iterative process													
Opportunity to rethink	X	X	X	X	X	X	X	Un-stated	X	X	X	X	X
Question-naire	Incl. inter-views	X	X	Incl. inter-views	X	X	-	Un-stated	X	X	X	X	X
Series of rounds	X	X	X	X	X	X	Physical meeting	Un-stated	X	X	X	X	X
Statistical aggregation of group response													
Aggregation	X	X	X	X	X	X	-	Unstated	X	X	X	X	X
Group of selected experts	Partici-pants of issue areas	X	Decision makers	Represen-tatives of groups	X	X	X	Unstated	X	Lobbyists	X	X	X

The results indicate that all variants show the generic characteristics of the Delphi Method (Table 2). The "X" label indicates that the Delphi variant corresponds to generic characteristics without exceptions. Hence, regarding the four fundamental characteristics, all Delphi Method variants can be considered Delphi Methods.

However, the methods differ regarding how they define expertise, their focus and objective, their level of anonymity, as well as their round 1 design. An expert suitable for a Delphi panel requires an individual who is at the top of his or her field of knowledge and is interested in a wide range of matters in his or her own field. The individual has to be able to see connections between national and international, as well as present and future developments. In addition, an expert must have the ability to see connections between different fields of science as well as the ability to disregard traditional points of view. Finally, the individual has to be able to regard problems from known, safe, and unconventional angles, as well as be interested in creating something new (Kuusi, 1999; Delbecq, van de Ven and Gustafson, 1975). Some Delphi Method variants, e.g., Decision and Policy Delphi, do not recruit panellists according to the expert definition above but instead focus on a specific group of selected experts. While Decision Delphi recruits only experts with regard to their actual position in the decision-making hierarchy, Policy Delphi requires informed advocates and referees for policy issues (Linstone and Turoff, 1975; Rauch, 1979).

Regarding focus and objective, seven of the 13 Delphi Method variants pursue defined objective goals and set their foci accordingly. For example, Argument Delphi tries to develop relevant arguments and expose underlying reasons for different opinions on a specific issue (Kuusi, 1999). For this purpose, arguments from different perspectives are the primary focus. The remaining six Delphi Method variants do not differ according to their foci and objectives, but how they apply technology (Real-Time, Electronic, Technological, and Online Delphi), their modifications (Modified Delphi), or simplification in relation to process steps (Mini-Delphi). Since focus and objective are directly related, we include them in one attribute called "focus and objective".

In Argument, Decision, EFTE, and Mini-Delphi, the participants in the panel are known from the beginning, but their responses remain anonymous. This quasi-anonymity is supposed to motivate panellists to answer the

questionnaire themselves and to not delegate the work due to lack of time, for example. Furthermore, the prestige of the other panel participants is presumed to provide a challenge and incentive (Rauch, 1979).

Finally, in Argument and Disaggregative Policy Delphi, the first round of the questionnaire is qualitative. It includes interviews for verbal argumentation or for making qualitative judgements (Kuusi, 1999).

4. Taxonomy development

The taxonomy development process, based on Nickerson, Varshney and Muntermann (2013) comprises four process steps: (1) choose a meta-characteristic of the object of interest, (2) specify dimensions, (3) define necessary conditions for the taxonomy, and (4) conceptualize characteristics.

The choice of the meta-characteristic should be based on the purpose of the taxonomy (Nickerson, Varshney and Muntermann, 2013). Hence, our meta-characteristic comprises the design and application of Delphi studies. The next step addresses specification of dimensions of the object of interest. Dimensions are frequently based on theory and serve as a starting point for conceptualizing the characteristics (Nickerson, Varshney and Muntermann, 2013). According to Miller (1994), the number of dimensions falls in the range of 7±2. Our analysis in Section 3 reveals that Delphi Method variants differ regarding how they define expertise (hereinafter referred to as panel participants), their focus and objective, their level of anonymity (hereinafter referred to as participant group), as well as their Round 1 design. Hence, we chose these four dimensions complemented by a fifth dimension, specifics of the panel. The latter dimension comprises recommendations concerning the size or composition of groups.

The third step comprises the definition of conditions. To establish consistency when deciding to consider a Delphi Method modification of a true variant, in addition to Classical Delphi, we propose that the following conditions should be met: (1) generic characteristics of Delphi are fulfilled, (2) a differentiating focus and objective exists, and (3) a sufficiently robust description of the Delphi Method variant is provided. Conditions (1) and (2) ensure that the respective Delphi Method variant can be considered as a Delphi Method and that it pursues a clear objective with a distinct focus. Condition (3) determines if an underlying rationale and description for this Delphi Method modification exists and qualifies it as a true variant. Table 3 shows the result of the first three process steps. The left column in Table 3 shows the dimensions mentioned above that characterize the differences in the seven Delphi Method variants that met the developed conditions.

Table 3: Differentiating dimensions of the remaining seven Delphi Method variants (in alphabetical order).

Dimensions/ Delphi variants	Argument Delphi (Kuusi, 1999)	Classical Delphi (Dalkey and Helmer, 1963)	Decision Delphi (Rauch, 1979)	Disaggregative Policy Delphi (Tapio, 2003)	EFTE Delphi (Nelms and Porter, 1985)	Policy Delphi (Linstone and Turoff, 1975)	Ranking-Type Delphi (Schmidt, 1997)
Focus and objective	Arguments: Develop relevant arguments and expose reasons	Facts: Elicit opinion and gain consen-sus	Decisions: Prepare and support decisions	Scenarios: Construct holistic scenarios	Opinions: Opinion capture in multi-disciplinary tasks	Ideas: Define and differen-tiate views	Rankings: Consensus about the relative importance of a set of issues
Panel participants	Group of experts	Homo-geneous groups of experts	Decision makers	Represen-tatives of interest groups	Group of experts	Informed advocates and referees	Group of experts
Participant group	Dependent panellists and anonymous response	Indepen-dent panellists and anonymous response	Dependent panellists and anonymous response	Indepen-dent panellists and anonymous response	Dependent panellists and anonymous response	Indepen-dent panellists and anonymous response	Indepen-dent panellists and anonymous response

Dimensions/ Delphi variants	Argument Delphi (Kuusi, 1999)	Classical Delphi (Dalkey and Helmer, 1963)	Decision Delphi (Rauch, 1979)	Disaggregative Policy Delphi (Tapio, 2003)	EFTE Delphi (Nelms and Porter, 1985)	Policy Delphi (Linstone and Turoff, 1975)	Ranking-Type Delphi (Schmidt, 1997)
Round 1 design	Interview; qualitative	Open; qualitative	Question-naire; quantitative	Question-naire and interview	Face-to-face interaction; question-naire	Question-naire; quantitative	Unstructure d; qualitative
Specifics of the panel	Should represent the research issue from different perspectives	Be high in absolute terms, i.e., many panellists	Cover a high percentage of the relevant decision makers	Consider different interest groups	Group of experts with no strong personality conflicts	Consider all relevant groupings	Should not be too large (to facilitate consensus)

In addition to the different focus and objectives, the remaining Delphi Method variants differ according to these four dimensions: (1) panel participants, (2) participant group, (3) Round 1 design, and (4) the specifics of the panel. The following paragraphs detail these dimensions.

1. Panel participants: In addition to a panel of experts in their respective areas of expertise, some variants choose a specific-focus group. Decision Delphi recruits its panellists only with regard to their actual position in the decision-making hierarchy (Rauch, 1979). Another example is Policy Delphi, which addresses only informed advocates and referees to reach the research objective (Linstone and Turoff, 1975).
2. Participant group: With all variants, the individual responses of the participating group are still anonymous. However, the participants' names of the Argument, Decision, and EFTE Delphi are known from the beginning. This is done to motivate the panellists to answer the questionnaire themselves (Rauch, 1979) and to argue their choices seriously (Kuusi, 1999). Participants in the EFTE Delphi are assembled face-to-face in a conference room and freely discuss the (anonymous) feedback results (Nelms and Porter, 1985).
3. Round 1 design: The first round of the Delphi study either includes a qualitative study to refine the research issues or immediately starts with a quantitative questionnaire.
4. Specifics of the panel: Proposals vary here. In Ranking-Type Delphi, for example, in order to facilitate consensus, the panel should not be too large (Paré et al., 2013). The panel of a Disaggregative Policy Delphi should consist of different interest groups to construct holistic scenarios (Tapio, 2003).

The fourth step in the process of taxonomy development is the conceptualization of characteristics. The dimensions serve as the basis for the choice of characteristics for our taxonomy. Table 4 shows that each dimension contains between two and seven characteristics.

Table 4: Dimensions and characteristics of Delphi Method variants

Dimensions	**Characteristics**						
Focus and objective	Arguments: Develop relevant arguments and expose reasons	Decisions: Prepare and support decisions	Facts: Elicit opinion and gain consensus	Ideas: Define and differentiate views	Opinions: Opinion captured in multi-disciplinary tasks	Rankings: Consensus about the relative importance of a set of issues	Scenarios: Construct holistic scenarios
Panel participant	Expert in narrow sense				Expert in broad sense		
Participating group	Restricted anonymity				Total anonymity		
Round 1 design	Qualitative				Quantitative		
Specific characteristics of panel	Size of panel should be high in absolute terms	Consider different groups of experts	Cover a high percentage of a specific group of experts	Should include a group of experts with no strong personality conflicts	Size of panel should not be too large		
Issues developed from	Experience of participants		Literature review		Pilot study		
Processing of the results	IT-supported				IT-supported in real-time		

Focus and objective clearly differentiate the Delphi Method variants from each other. Regarding the panel participants involved, a differentiation between an expert in a narrow sense and an expert in a broad sense can be observed. An expert in a narrower sense comprises the generally known definition of an expert suitable for a Delphi panel (cf. p.5) according to Delbecq, van de Ven and Gustafson (1975) and Kuusi (1999). An expert in a broader sense covers a specific-focus group, e.g., decision makers or representatives of interest groups. Experts assigned to this category do not necessarily have a wide range of knowledge in their own fields; their expert status results from their actual position in the decision-making hierarchy or their affiliation with an interest group.

The participating group is restricted or anonymous. Restricted anonymity means that the participants know each other's names or directly exchange feedback while their responses remain anonymous. In the case of anonymity, panellists, as well as their responses, remain anonymous.

The first round of Delphi can be qualitative, i.e., more exploratory, quantitative, or more confirmatory (Skinner et al., 2015). A qualitative first round works best when situations are vague, ill-defined, or contradictory (Hasson, Keeney and McKenna, 2000). A quantitative first round is useful when the scenario is generally less ambiguous and is customarily undertaken by giving the panel a predefined set of issues to explore (Niederman, Brancheu and Wetherbe, 1991).

Regarding the specific characteristics of the panel, some recommendations exist concerning the breadth and depth of the panel and the composition of groups. The panel should be high in absolute terms to get the most significant possible results, but should not be too large to reach a consensus. Furthermore, a high percentage of a specific group is encouraged to gain particular insights or consider a number of different groups to get results from multiple perspectives**.** Additionally, strong personality conflicts within the group of experts should be avoided. Otherwise, conflicts may occur.

Furthermore, we recognize two characteristics that did not arise from specific Delphi Method variants but are still important for Delphi in general. The first characteristic concerns the source from which issues are developed. The issues for Round 1 could originate from a previously performed or already published literature review, having emerged from a previously executed pilot study or from an examination of participants' experiences. The selection is carried out in accordance with the research content and status is independent of a specific variant.

The second characteristic comprises the results processing. All Delphi studies use some form of software, i.e., IT. Beyond this, IT can be used to give responses in real time. Such systems evaluate responses obtained from respective iterations and directly display results.

5. Evaluation of taxonomy

Upon completion, the resulting taxonomy needs to be evaluated for its usefulness (Nickerson, Varshney and Muntermann, 2013). We, therefore, evaluate our taxonomy twice. First, we apply it to selected IS research published in highly-ranked IS journals (Section 5). This evaluation addresses whether a purposeful and unambiguous determination of Delphi method variants using the taxonomy is possible. Second, we evaluate the practical applicability of the taxonomy by using it to define the specific Delphi design for one of our research projects (Section 6). The application of the taxonomy should demonstrate whether a clear definition of the selected Delphi Method variant and its characteristics can be made. We use three articles from our subset "Application of Delphi Research" (Section 2, p. 2f.) for the first evaluation. These papers examine:

1. key factors affecting transnational knowledge transfer (Duan, Nie and Coakes, 2010),
2. how organizations can effectively implement IT governance in practice (Haes and van Grembergen, 2008), and
3. the future impact of enterprise resource planning (ERP) on Supply Chain Management (SCM) (Akkermans et al., 2003).

We selected the three articles because each one uses a different Delphi Method variant, includes a comprehensive description of the methodology, and was published in different top-tier IS journals. The first study (Duan, Nie and Coakes, 2010) applies a Classical Delphi Method variant to reach a consensus about the most important factors, while the second study (Haes and van Grembergen, 2008) uses a Ranking-type variant of Delphi as a technological forecasting tool applied to develop a necessary set of top 10 practices for implementing IT governance. The third study (Akkermans et al., 2003) differs by implementing an EFTE approach to understand the impact of ERP on SCM. Table 5 illustrates the evaluation results.

Table 5: Evaluation results (the numbers in brackets refer to the IS research articles mentioned above)

Dimensions	**Characteristics**						
Focus and objective	Arguments: Develop relevant arguments and expose reasons	Decisions: Prepare and support decisions	Facts: Elicit opinion and gain consensus (1)	Ideas: Define and differentiate views	Opinions: Opinion captured in multi-disciplinary tasks (3)	Rankings: Consensus about the relative importance of issues (2)	Scenarios: Construct holistic scenarios
Panel participant	Expert in narrow sense (1) (2) (3)				Expert in broad sense		
Participating group	Restricted anonymity (3)				Total anonymity (1) (2)		
Round 1 design	Qualitative (1) (2) (3)				Quantitative		
Specific characteris-tics of panel	Be high in absolute terms (1)	Consider different groups of experts	Cover a high percentage of a specific group of experts		Should include a group of experts with no strong personality conflicts (3)	Should not be too large (2)	
Issues developed from	Experience of participants (3)		Literature review (1) (2) (3)			Pilot study (2)	
Processing of the results	IT-supported (1) (2)				IT-supported in real-time (3)		

Overall, within the default characteristics noted above, a purposeful and unambiguous determination is possible. It is apparent that the study of Akkermans et al. (2003) describes the specifications of an EFTE Delphi without naming this variant. However, the characteristics of the respective Delphi Method variants are not

directly mentioned in those studies. Our taxonomy addresses these deficits by offering a clear definition of Delphi Method variants and their characteristics. Any potential deviations can be made transparent without creating new variants or declaring them as "modified".

6. Exemplary application of the taxonomy

As Section 5 shows, the proposed taxonomy can be successfully applied to existing IS research. This indicates that the taxonomy is comprehensive and helps to clearly distinguish features that differentiate the Delphi Method. A logical next step is to apply our approach to a new Delphi research project. The additional step is useful to evaluate the practical applicability of the taxonomy and to show that it helps specify the chosen research method unambiguously. For that purpose, we use the taxonomy to define a research proposal using Delphi to investigate the organizational role of a so-called offshore coordinator. The offshore coordinator connects the onshore and offshore organization and facilitates the knowledge transfer process. The objective of this study is to identify the main tasks of the offshore coordinator role as well as the necessary skills to perform this role. The grey-marked squares in Table 6 illustrate the chosen research approach along the suggested taxonomy.

Table 6: Characteristics of our research approach

Dimensions	**Characteristics**						
Focus and objective	Arguments: Develop relevant arguments and expose reasons (*Argument Delphi*)	Decisions: Prepare and support decisions (*Decision Delphi)*	Facts: Elicit opinion and gain consensus (*Classical Delphi*)	Ideas: Define and differentiate views (*Policy Delphi*)	Opinions: Opinion captured in multi-disciplinary tasks (*EFTE Delphi*)	Rankings: Consensus about the relative importance of a set of issues (*Ranking-Type Delphi*)	Scenarios: Construct holistic scenarios (*Disaggregative Policy Delphi*)
Panel participant	Expert in narrow sense				Expert in broad sense		
Participating group	Restricted anonymity				Total anonymity		
Round 1 design	Qualitative				Quantitative		
Specific characteristics of panel	Size of panel should be high in absolute terms	Consider different groups of experts		Cover a high percentage of a specific group of experts	Should include a group of experts with no strong personality conflicts	Size of panel should not be too large	
Issues developed from	Experience of participants		Literature review		Pilot study		
Processing of the results	IT-supported				IT-supported in real-time		

To meet our objective, we use a Classical Delphi method variant (Dalkey and Helmer, 1963) for our study design. Classical Delphi serves as a forum of facts to elicit opinions and seek a consensus. This Delphi method variant is most suitable to determine an agreeable set of tasks the offshore coordinator role typically performs and the necessary skills he or she needs.

Experts suitable for the study are managers or practitioners with proven expertise in IS projects transferring knowledge to near- or offshore locations. They should be directly involved in IS offshoring initiatives, incorporating the transfer of knowledge from Germany to near- or offshore countries. Hence, our panelists are experts in a narrow sense.

During the series of questionnaires, the responses are only sent to researchers who anonymize all replies. This total anonymity allows group participants to express their opinions individually without any influences from other panel members.

The first round is qualitative and includes open questions according to the summarized literature findings regarding the offshore coordinator's tasks and skills. This design offers freedom for experts to comment on these findings and generate ideas and issues.

The size of the panel should not be too large to reach a consensus. Although there is no agreement on the optimal number of subjects for a Delphi study in general or a Classical Delphi in detail (Skinner et al., 2015; Paré et al., 2013), we follow the recommondation of Delbecq, van de Ven and Gustafson (1975) and aim to reach a panel size of approximately 30 participants across the total number of rounds.

The questions for the first round are developed through an extensive literature review (Strasser and Westner, 2015). Further on, the participants' experience is used to evaluate the literature findings critically as well as to enhance the amount of findings for the subsequent quantitative rounds.

For the questionnaire and result processing, we used a web-based questionnaire tool for data gathering. We compared different tools according to their features and selected LimeSurvey.

Using the developed taxonomy, as illustrated, allowed for identification of the Delphi characteristics where we needed to make methodological and explicit decisions. The example shows that this provides a straightforward research method description that is both concise and unambiguous.

7. Conclusion

In this work, we analysed existing research to identify variants of the Delphi Method and their characteristics. We found 13 Delphi Method variants differentiated in IS research and analysed them critically. The results indicate that all variants show the four generic characteristics of the Delphi Method but differ regarding how they determine expertise, their focus and objective, as well as their level of anonymity (RQ1).

While the definition of the respective Delphi Method variants is inconsistent, and six of these variants lack a clear objective and focus (RQ2), we suggest three conditions that must be met to accept a Delphi Method modification as a Delphi Method variant. By applying these conditions to the identified 13 Delphi Method variants, seven clearly distinguishable variants with different focus and objectives remain (RQ3). We describe the specifications of these Delphi Method variants in detail and generalize these findings to develop a taxonomy. This taxonomy includes seven characteristics and 23 specifications to clearly differentiate and characterize Delphi Method variants (RQ4).

We evaluate our taxonomy twice. First, we apply it to selected IS research published in highly ranked IS journals. This evaluation reveals that a purposeful and unambiguous determination of the chosen method variant using the taxonomy is possible. Thus, we tentatively claim that the taxonomy is comprehensive and helps clearly distinguish differentiating features of the Delphi Method. Second, we illustrate the practical application of the taxonomy by using it to define the specific Delphi design for one of our research projects. Application of the taxonomy demonstrates that a clear definition of the selected Delphi Method variant and its characteristics can be easily, yet precisely, documented (RQ5). Overall, this will help researchers in specifying their research method concisely and unambiguously, without burdening readers of research papers with verbose sections on methodology. Relevant IS research should consider practitioners and not only researchers as a possible audience. This might help make research papers more readable for the target group without harming research rigor.

From a research perspective, we claim that awareness of the developed taxonomy enhances research rigor. The findings clearly show that the Delphi Method has been adapted in various ways, which may cause methodological problems and undermine rigor because it presumably creates new Delphi Method variants. These variants are, in fact, not substantially different to those already existing. We analyse these different Delphi Method variants, their characteristics, and offer insights to researchers by providing a taxonomy to point out the methodological decisions they must make and to describe their research approach clearly. We believe that a careful consideration of our taxonomy intensifies understanding of the applied Delphi Method variants in IS research and contributes to enhancing methodological rigor when using the Delphi Method.

There are certain limitations of this study. First, we cannot be sure that we found every relevant Delphi Method-based publication despite a thorough and broad literature retrieval process. Second, the evaluation of the developed taxonomy is limited to three highly ranked journals and one application in practice. Future research could apply our proposed taxonomy to more IS research using Delphi Method variants. The findings

could help develop our taxonomy to improve the rigor of Delphi studies conducted in the IS community. Third, we conducted this study in one research discipline only, but tentatively claim that results can be transferred to other disciplines that have started using Delphi more extensively. We argue that other disciplines that have started adopting Delphi more recently could be encouraged to avoid methodological ambiguity from the beginning of broader adoption of Delphi within their disciplines.

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