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Using Delphi technique to build consensus in practice

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Abstract

This paper focuses on the use of Delphi technique in building consensus in practice. More specifically, it reviews some fuzzy issues regarding the expert's panel selection and the questionnaire design, while it provides two case examples for the consensus measurement. Hence, examining some controversies, it makes obvious that the purpose of the study and the homogeneity of the sample are crucial factors when designing the Delphi procedure. However, what still remains unclear is the approach in measuring consensus, which varies from study to study. In this case, the present paper recommends a complementary use of three measures to assess consensus, since each one separately could not be thought of as a good proxy of it. These measures are: (i) the interquartile range, (ii) the standard deviation and (iii) the 51% percentage of respondents lying in the 'highly important' or 'strongly agreeing' category.

Keywords: Delphi method, methodological problems, consensus building, application, research guidelines

1 INTRODUCTION

Delphi technique was firstly introduced by Rand Corporation in 1950 and evolved as a 'consensus' tool in 1970. It was based on the assumption that 'group judgments' are more reliable than individual's and has applications on various sectors, such as public health, public transportation, education etc. (Dalkey, 1969; Kittell-Limerick, 2005: 55). This technique is preferred as a problem solving or policy making tool when the knowledge about a problem or a phenomenon is incomplete and is used with the aim of obtaining the most reliable group opinion (Adler & Ziglio, 1996; Kittell-Limerick, 2005: 53; Kreitner & Kinecki, 1992). Thus, Delphi is used in forecasting tasks when there is no appropriate or available information and is based on the assumption that "*N+1 heads are better than one*" (Hill, 1982; Nerantzidis, 2012; Rowe & Wright, 2001).

Delphi has been criticized for 'apparent consensus' (Rowe & Wright, 1999: 363). However, it is supported that consensus is not forced but elicited (Shields, Silcock, Donegan, & Bell, 1987), with the results being conducted and recorded through a focused conversation, without the disadvantages of the interpersonal conflict (Agwe & Sharif, 2007; Dalkey & Helmer, 1963; Landeta, 2006).

Even if this method measures the consensus, there is no common practice regarding the statistical analysis of the results, with this approach varying from study to study (Landeta, 2006). In addition, critics about its lack of accuracy and reliability check are also existent (see Landeta, 2006). Undoubtedly, the aim of this paper is to provide practical assistance to management or business researchers in designing and applying the Delphi technique. For this reason, the purpose of the case examples presented is to clarify the way of reaching consensus among experts. Hereafter, the main characteristics of Delphi technique along with the questionnaire design, the expert's panel selection and the consensus measurement are described, whilst 32 prior empirical studies in the field of management and business are presented in order to record a trend on these issues. Finally, two case examples are provided for an in depth understanding.

2 DELPHI PROCEDURE

2.1 Background

Delphi technique is considerably desirable to reach consensus on a field where a lack of agreement or incomplete knowledge is evident. Its application is primarily based on *anonymity*, giving the opportunity to participants to express their opinions freely, eliminating any possible personal conflict (Christie & Barela, 2005; Dalkey, 1969; Linstone & Turoff, 1975; Skulmoski, Hartman, & Krahn, 2007). Respectively, it is characterized for (i) iteration, which allows participants to reconsider and refine their opinion, (ii) controlled feedback, which provides them with information about the group's perspectives in order to clarify or change their views and (iii) statistical response, to represent the group's views quantitatively (Dalkey, 1969; Landeta, 2006; Rowe & Wright, 1999; Shields et al., 1987; Skulmoski et al., 2007).

However, two of the most fundamental issues in Delphi application are related with the questionnaire design and the expert's panel selection. The former is referred to the Likert scale choice and the number of rounds, while the latter to the panel size, its main characteristics and the response rate.

2.2 Questionnaire design

Of the first priorities when conducting such a research, is to decide upon the questionnaire structure and the appropriate rounds. On the one hand, the Likert scale choice depends on the study's purpose. This means that when the researcher wants to identify between three situations, a 3-Likert scale is used, while when he/she attempts to assess the degree of agreement, he/she usually chooses a 10-point one (Christie & Barela, 2005). On the other hand, the Delphi rounds are not an easy task as they are usually related with the group size. This means that, although Delphi is a repeated process of 'feedback' until consensus is reached, in most cases – when the sample is small – no more than one round may be needed (Mullen, 2003). However, a minimum of two rounds is required in order to allow feedback and 'revision of responses' (Butterworth & Bishop, 1995; Christie & Barela, 2005; Gallagher, Branshaw, & Nattress, 1996; Mullen, 2003). Respectively, there are also cases where three rounds are usually recommended (for large samples, >30) (Christie & Barela, 2005; Dalkey, Rourke, Lewis, & Snyder, 1972; Helmer, 1967; Linstone & Turoff, 1975). Nevertheless, the scope of the study, for example when the goal is to understand the 'nuances', and the sample homogeneity may accept a smaller number; i.e. less than 3 rounds (Skulmoski et al., 2007). Undoubtedly, it is up to the researcher

to choose his/her study rounds, while, according to Landeta (2006: 479), he/she may prefer to sacrifice rounds in order to "*guarantee panel participation and continuity*".

2.3 Experts' panel

When constructing the experts' panel it is important to consider that their experience ('expertise') or knowledge ('knowledgeability') determines the reliability and validity of the results (Adler & Ziglio, 1996; Kittell-Limerick, 2005: 53; Rowe & Wright, 1999). Hence, the experts should satisfy four requirements: (i) to acquire knowledge and experience through investigation, (ii) to be willing to participate, (iii) to have sufficient time (to participate) and (iv) to possess effective communication skills (Adler & Ziglio, 1996; Skulmoski et al., 2007). In any case, 'knowledgeable persons' could be identified either through literature search or recommendations from institutions and other experts, demanding techniques of purposive and snowball sampling (for more information, see Bryman & Bell, 2011: 192-193; Saunders, Lewis, & Thorhill, 2009: 237-240).

In addition, two more important factors, when conducting Delphi technique, are the panel size and the response rate. In both cases, there are not strict rules. It is referred that the group size is highly related to the purpose of the investigation (Cantrill, Sibbald, & Buetow, 1996; Mullen, 2003) and the response rate may be ranging between the different disciplines, according to the participants' research interest (Mason & Alamdari, 2007). However, it is evident that the group error reduces and the decision quality is reinforced as the sample increases (Skulmoski et al., 2007); Although the sample ranges from 7 to 30 (Armstrong, 1985; Cavalli-Sforza & Ortolano, 1984; Dalkey, 2003; Mullen, 2003; Phillips, 2000; Turoff, 1970), the 'drop-out' rate is higher in large groups (Reid, 1988). In any case, it is believed that a sample size of 20 tending to retain the members (Mullen, 2003). Undoubtedly, what determines the panel's size selection is the homogeneity, since in this case a sample of between 10 to 15 people can yield sufficient results (Skulmoski et al., 2007) and assure validity (Listone & Turoff, 1975).

3 MEASURING CONSENSUS

Although the principal aim of Delphi technique is to reach consensus among the participants, still a common practice to measure it does not exist. Hence, there are studies that measure agreement through frequency distributions and others using the standard deviation or the interquartile range. In the first case, the percentage of responding to any given category is defined, which according to McKenna (1989) is determined to 51%, while there are cases where a specified distance from the mean is also considered. For example, Christie & Barela (2005: 112) propose that at least 75% of participants' responses should "*fall between two points above and below the mean on a 10-point scale*". As for the studies using standard deviation or interquartile range to assess consensus, the former should be less than 1.5 (Christie & Barela, 2005) and the latter less than 2.5 (Kittell-Limerick, 2005) or 1 (Raskin, 1994; Rayens & Hahn, 2000: 311).

However, each analysis should also include the calculation of mean and median, since these are used to describe the middle and most typical response, depicting the central tendency (Binning, Cochran, & Donateli, 1972; Kittell-Limerich, 2005), as well as the coefficient of variation (i.e. the division of the standard deviation with the mean), denoting the observations' homogeneity, and the mode, representing the most frequently occurred value (Gupta & Waymire, 2008: 104; Saunders et al., 2009: 444-448).

4 PRIOR EMPIRICAL STUDIES USING DELPHI TECHNIQUE

In this part, a number of studies, using Delphi technique, between years 1975 to 2013 in the scientific fields of management and business were chosen. These studies are summarized in table 1 focusing on the way they used Delphi and providing implications for the most controversial issues of the panel size, the Likert scale, the measure of consensus and the Delphi rounds.

More specifically, in the first two columns the authors (in chronological order) and the country of research are referred. From the total 32 studies analyzed here, 11 were conducted in Europe, 9 in USA, 4 in Canada, 3 in Asia, 2 in Africa and 1 in Australia; while 2 were cross-national.

The third column depicts the participants in every study, showing that the majority uses a number up to 30 experts, namely 18 out of 32 studies. In these 18 studies of Delphi 10 used the opinion of less than 20 experts. However, there are studies using more than 30 experts, with the number ranging between 30 and 50 participants in 5 studies and between 50 and 100 in 4 more. Also, there are 5 studies which used an even greater number of participants, i.e. >100.

Focusing on the Likert point scale (fourth column of table 1), it is obvious that 10-point and 5-point scales are the most common, since these are used by the 29 out of 32 studies (14 studies using a

10-point scale and 15 studies a 5-point one). Nevertheless, the most important in the Likert point scale selection is the aim of the study. What can be extracted by the use of the Likert point scale, is that a 10-point one is used when the level of importance is investigated, since from the 14 studies which used the 10-point scale, 11 measured the importance while from the 15 studies that used the 5-point scale, only 3 did so. On the other hand, when the level of agreement is investigated, or in case of increase/decrease measurement, a 5-point scale is most common. This could be inferred by the fact that 5 out 15 studies used a 5-point scale to investigate the level of agreement and 3 the level of decrease/increase, while only 1 out of 14 studies which used a 10-point scale measured the level of agreement.

The fifth column shows the measure of consensus with the majority of studies (12 out of 32) using the standard deviation. An also common measure of consensus is the interquartile range which in many cases is used supplementarily with standard deviation, or with median, or with a specific percentage of the participant responding to a given category, as for example the percentage of experts responding to the 'strongly agreeing' category, or the percentage of experts responding to the 'highest priority' category etc. However, there are also cases using only the percentage of the participant responding to a given category as an exclusive measure of consensus, others using the coefficient variation and others implementing the Kendall's coefficient W. Also, there are studies combining the standard deviation with the coefficient variation, or the standard deviation with the mean, or even more the interquartile range with the standard deviation and the median, or the interquartile range with the median and the percentage of the participant responding to a given category.

Finally, focusing on the number of rounds implemented for reaching consensus, the last column shows that the majority needed 2 or 3 rounds. From the 32 studies presented in table 1, 17 reached consensus after two rounds, 11 after three rounds, 2 after four rounds, 1 after five rounds and an additional one used a combination of two panels, reaching consensus in the 2^{nd} and the 4^{th} round respectively.

Table 1: Prior empirical studies of Delphi

No	Authors	Research scope	Country	Participants	Likert-scale	Measure of consensus	Delphi Rounds
1	Lamb (1975)	This study appraises 12 research projects in the field of electricity utilization by using Delphi combined with benefit/cost rankings	Canada	160	10-point (zero/negligible value to extremely valuable research program)	IR[1]	2 rounds
2	Ley & Anderson (1975)	The Delphi technique was used to forecast the urban development of Nanaimo, British Columbia along a range of physical, social and political dimensions.	Canada	52	5-point	IR	2 rounds
3	Kaynak & Macaulay (1983)	Gather data concerning the factors that will influence the future growth of tourism	Europe (Scotia)	1st round: 111/150 2nd round: 44/60	5-point (significant decrease to significant increase)	SD[2]	2 rounds
4	Nelms & Porter (1985)	This study estimates the maximum possible impact that technology could have on clerical productivity as well as the actual expected impact.	USA (Atlanta, Georgia)	10	n/d3	SD, IR, median	2 rounds
5	Fish & Piercy (1987)	This study used Delphi to examine the similarities and differences in the theory and practice of structural and strategic family therapy	USA	32	7-point for agreement	IR, median	3 rounds
6	Green, Hunter & Moore (1990)	Assessment of the environmental impacts stemming from tourist projects.	Europe (UK)	Preliminary stage: 40 1st Round: 31 2nd Round: 21	n/d	SD and CV[4]	2 rounds & a preliminary stage
7	Niederman, Brancheau & Wetherbe (1991)	The study uses Delphi to determine the most critical issues in Information Systems (IS) management. For this reason the importance of 25 issues was investigated.	USA	1st round: 114/241 2nd round: 126/241 3rd round: 104/175	10-point (least important to most important)	SD	3 rounds
8	Kaynak, Bloom & Leibold (1994)	This study uses Delphi to analyze the future of tourism in South Africa by investigating factors which will influence the future growth of the tourism industry	South Africa	1st round: 50/100 2nd round: 37/50	5-point (significant increase to significant decrease) and 10-point (non important to critically important)	SD	2 rounds
9	Dekleva & Zupančič (1996)	Evaluating the importance of 26 IS management issues	Europe (Slovenia)	1st Round: 105/330 2nd Round: 163/330 3rd Round: 129/186 4th round: 148/186	10-point (from unimportant to most important)	SD	4 rounds

10	Greninger et al. (2000)	Delphi was used to determine retirement planning guidelines: to ascertain retirement planning considerations and guidelines, to determine if a consensus of opinion existed or could be established and to determine what differences in opinions might exist.	USA	188	5-point (definitely do not agree to strongly agree)	% of experts responding to categories: agree, uncertain and disagree.	3 rounds
11	Hayne & Pollard (2000)	Assessing the importance of 23 issues in Information Systems (IS) management.	Canada	157	10-point (least important to most important)	SD	2 rounds
12	Miller (2001)	The study used Delphi technique in order to develop indicators to measure the movement of the tourism product at a company/resort level towards a position of greater or lesser sustainability. More specifically, the author ascertained the opinion of experts on indicators presented to measure movement towards sustainable tourism.	Europe	1st Round: 54/74 2nd Round: 37	5-point (strongly disagree to strongly agree)	SD	2 rounds
13	Keil, Tiwana & Bush (2002)	The study explores the issue of IT project risk from the user perspective and compares it with risk perceptions of project managers.	USA	15	10-point of importance	Kendall's coefficient of concordance (W)	2 rounds
14	Hackett, Masson & Phillips (2006)	The study explores levels of consensus among practitioners about good practice in relation to youth who are sexually abusive.	Europe (UK & Ireland)	78	10-point (strongly disagree to strongly agree) 5-point (no relevance to highly relevant)	IR, median, % of strongly agreeing statement (8-10 and 4-5)	3 rounds
15	Kaynak & Marandu (2006)	The study explores the most probable scenario for the tourism industry in Botswana by the year 2020. For this experts commended on the extent of changes in societal values and ranked the expected impact these changes would have on the industry.	Africa (Botswana)	1st round: 104 2nd round: 68	5-point (significant decrease to significant increase) and 10-point (no impact at all to very high impact)	SD	2 rounds
16	Ku Fan & Cheng (2006)	The study uses Delphi technique in order to identify the needs for continuing professional development for life insurance sales representatives and to examine the competencies needed by those sales representatives.	Asia (Taiwan)	10	5-point (strongly disagree to strongly agree)	SD	3 rounds
17	Saizarbitoria (2006)	The scope of this study was to analyze the influence on companies' performance of the two most important models for Quality Management practice, using Delphi technique.	Europe (Spain)	27	11-point	IR, median	2 rounds

18	Mason & Alamdari (2007)	The paper used Delphi to forecast the structure of air transport in EU in 2015 in respect of network carriers, low cost airlines and passenger behavior. For this reason the experts were required to agree or disagree with 27 statements.	EU	26/61	5-point	A 75% of agreement as a "broad consensus" threshold.	2 rounds
19	Chang et al. (2008)	Delphi was used to assess the importance or ERP life cycle activities	Asia (Taiwan)	1st round: 27/40 2nd round: 24	10-point for importance	SD	2 rounds
20	Czinkota & Ronkainen (2008)	The scope of the study was to identify international business dimensions subject to change in the next 10 years and highlight the corporate and policy responses to these changes	Africa Asia Europe America	34	10-point (very low impact to very high impact)	n.d.	3 rounds
21	Nakatsu & Iacovou (2009)	They investigated the importance of 25 risk factors of outsourced software development from a client perspective in domestic and offshore settings	USA	1st round: 29/32 2nd round: 26/32 3rd round: 27/32	10-point (unimportant to very important)	SD	3 rounds
22	Lee & King (2009)	The study proposes a guiding framework for the future development of hot springs tourism in Taiwan, drawing upon factors influencing the competitiveness of the sector.	Asia (Taiwan)	1st round: 31/36 2nd round: 28/31 3rd round: 26/28	5-point for importance	IR<1 & 80% responded to categories "highest priority" (mean score above 4.5) and "important elements" (means score between 4 and 4.49)	3 rounds
23	Asonitis & Kostagiolas (2010)	Delphi technique was employed to highlight the most important library services for the central Greek public libraries.	Europe (Greece)	1st round: 11/12 2nd round: 9/12	10-point for importance	CV	2 rounds
24	Geist (2010)	Evaluating the importance of organizational goals and a follow-up survey asking questions about the ease of use, the merit or value and enjoyment	USA	Paper-pencil delphi: Round 0: 14/30 Round 1: 16/30 Round 2: 12/30 Round 3: 13/30 Real-time Delphi: Round 0: 10/30 Round 1: 11/30	7-point (not important to very important 5-point (strongly disagree to strongly agree)	SD, IR	4 rounds & 2 rounds

25	Hussein (2010)	The study examines Corporate Social Responsibility (CSR) theorists' criteria from the corporate executive's perspective. For this reason it uses Delphi technique in order to identify specific criteria recognized and used by organizational executives vital to evaluating CSR.	USA	1st round: 26/35 2nd round: 27/35 3rd round: 25/35	5-point for importance	IR<1.2	3 rounds
26	Culley (2011)	This study uses Delphi to evaluate the efficacy of using online computer, Internet and e-mail applications.	USA	18	7-point (not useful to very useful)	IR, ≥70% agreement	2 rounds
27	Giannarakis, Litinas & Theotokas (2011)	The paper identifies both general and sector-specific indicators in order to measure the Corporate Social Responsibility (CSR) performance in Telecommunication sector	Europe (Greece)	8/17	n/d	SD	3 rounds
28	Post, Rannikmäe & Holbrook (2011)	The study aims to create a theoretical tool for determining competencies and knowledge in science education (which a school leaver should have in order to be successful in the workforce and/or as a citizen in society).	Europe (Estonia)	1st round: 38 2nd round: 85	5-point (non important to very important)	Mean (divided into two categories: over 4 and under 3) SD	2 rounds
29	Hadaya, Cassivi & Chalabi (2012)	The purpose of the study is to identify the most important IT project management resources and capabilities.	Canada	1st round: 30/34 2nd round: 30/30 3rd round: 28/30 4th round: 24/28 5th round: 19/24	10-point for importance	Kendall's W	5 rounds
30	Hefferan & Wardner (2012)	It uses Delphi to demonstrate how demand drivers and accommodation priorities for emerging knowledge-intensive firms are understood and how corporate property and asset managers can respond to them.	Australia	11	5-point (low priority to very high priority)	n/d	4 rounds
31	Goula (2013)	This study uses Delphi technique to explore ways of public transition from bureaucracy to a participation-culture model of human resources.	Europe (Greece)	10/12	5-point (strongly disagree to strongly agree)	IR, SD	2 rounds
32	Jones, Day & Quadri-Felitti (2013)	This study uses Delphi to determine what defines "boutique" and "lifestyle" hotels.	Europe USA Asia	1st round: 20 2nd round: 24 3rd round: 25	10-point (least important to most important)	SD	3 rounds

1. IR: interquartile range

2. SD: standard deviation

3. n/d: not defined

4. CV: coefficient variation

5 CASE EXAMPLES

5.1 Design

The presented case examples focus on one of the most controversial issues in Delphi technique application, namely the consensus measurement. This issue triggered our effort to provide complete guidelines to conduct Delphi as a means of eliciting experts' opinion. Based on our experience, the way of reaching consensus, is presented, using two case examples to illustrate how the various measures of consensus could be applied in practice. These examples are used to indicate our basic conclusions on consensus measurement in a practical way.

In the following two case examples, the way of eliciting the experts' opinion is demonstrated, regarding the importance of 10 variables and their agreement upon 8 statements respectively; which are two of the most common uses of Delphi (see for example Geist, 2010; Hadaya, Cassivi, & Chalabi, 2012; Hayne & Pollard, 2000; Ku Fan & Cheng, 2006; Miller, 2001; Nakatsu & Iacovou, 2009). For this reason, a well-structured questionnaire is formulated (see appendix 1); using a 10-Likert scale for assessing the importance of a variable (1st case) and a 5-Likert one for the measurement of agreement (2nd case). The data that are used to illustrate these case examples are taken in part from one of the authors PhD thesis. However, since the aim of this study is to provide guidance to any researcher in any scientific field, the names of the variables and the statements are not referred. Nevertheless, the selected data are used to describe the problems that may arise in the consensus measurement and are described thereafter.

5.2. 1st Case

In the first case, the consensus measurement when the scope of a Delphi study is to assess the importance of a variable is demonstrated. Such examples are the Hayne and Pollard's (2000) study, where the importance of 23 issues in Information Systems (IS) management was evaluated, or the Nakatsu and Iacovou's (2009) one where the importance of 25 risk factors of outsourced software development from a client perspective in domestic and offshore settings was investigated.

To illustrate this case, in a Likert scale of 0-10 (respectively for non- and high- importance) (Asonitis & Kostagiolas, 2010; Ishikawa et al., 1993; Mullen, 2003; Nerantzidis, 2013), the opinion of 12 experts is shown in table 2.

To assess consensus, three measures are used combinatory:

(i) The 51% responding to the category 'highly important', which is between values 8 and 10 on a 10-Likert scale (Hackett, Masson & Phillips, 2006),
(ii) the interquartile range below 2.5 (Kittell-Limerick, 2005) and
(iii) the standard deviation below 1.5 (Christie & Barela, 2005).

Each of the above three measures has been separately proposed for consensus measurement. However, there are cases where the interquartile range may be lower than 2.5 and/or the standard deviation lower than 1.5, but only a low percentage of experts (less than 51%) evaluate the variable as 'highly important' (between values 8 and 10). Respectively, it is also possible that although at least 51% of the experts evaluate a variable as 'highly important', its interquartile range may be higher than 2.5 or/and its standard deviation higher than 1.5. These cases are presented in table 2 in variables 4,7 and 8.

Table 2: Delphi results regarding the importance of the variables

	1st Expert	2nd Expert	3rd Expert	4th Expert	5th Expert	6th Expert	7th Expert	8th Expert	9th Expert	10th Expert	11th Expert	12th Expert	**median**	**Q1**	**Q3**	**Q=Q3-Q1**	**mode**	**average**	**8-10%**	**standard deviation**	**CV**
1st Delphi round																					
Variable 1	10	9	7	10	9	10	8	7	9	9	9	8	9	8	9.3	**1.25**	9	8.75	**83.33**	**1.06**	0.12
Variable 2	9	9	9	9	8	9	8	9	9	9	8	9	9	8.8	9	**0.25**	9	8.75	**100.00**	**0.45**	0.05
Variable 3	9	9	10	9	8	8	10	9	9	8	8	7	9	8	9	**1.00**	9	8.67	**91.67**	**0.89**	0.10
Variable 4	5	7	9	9	8	8	9	8	5	8	4	9	8	6.5	9	2.50	9	7.42	**66.67**	1.78	0.24
Variable 5	10	10	10	8	9	6	10	10	8	9	10	10	10	8.8	10	**1.25**	10	9.17	**91.67**	**1.27**	0.14
Variable 6	10	9	4	9	6	3	5	6	9	8	6	6	6	5.8	9	3.25	6	6.75	41.67	2.22	0.33
Variable 7	8	9	7	8	6	5	8	9	6	8	5	7	7.5	6	8	**2.00**	8	7.17	50.00	**1.40**	0.20
Variable 8	6	7	9	8	6	8	5	8	4	8	5	7	7	5.8	8	**2.25**	8	6.75	41.67	1.54	0.23
Variable 9	10	9	4	8	7	10	9	9	10	8	10	8	9	8	10	**2.00**	10	8.50	**83.33**	1.73	0.20
Variable 10	7	10	6	8	8	6	8	9	3	6	6	8	7.5	6	8	**2.00**	6	7.08	50.00	1.83	0.26
2nd Delphi round																					
Variable 1	10	9	-	9	9	10	8	8	9	-	9	8	9	8.3	9	**0.75**	9	8.90	**100.00**	**0.74**	0.08
Variable 2	9	9	-	8	8	9	8	9	9	-	8	9	9	8	9	**1.00**	9	8.60	**100.00**	**0.52**	0.06
Variable 3	9	9	-	9	8	8	10	9	9	-	8	8	9	8	9	**1.00**	9	8.70	**100.00**	**0.67**	0.08
Variable 4	5	7	-	8	8	8	9	8	7	-	5	9	8	7	8	**1.00**	8	7.40	**60.00**	**1.43**	0.19
Variable 5	10	10	-	9	9	8	10	10	9	-	10	10	10	9	10	**1.00**	10	9.50	**100.00**	**0.71**	0.07
Variable 6	10	7	-	8	6	4	5	6	8	-	6	6	6	6	7.8	**1.75**	6	6.60	30.00	1.71	0.26
Variable 7	8	8	-	9	7	5	8	9	9	-	7	7	8	7	8.8	**1.75**	8	7.70	**60.00**	**1.25**	0.16
Variable 8	6	8	-	7	6	8	5	8	6	-	5	7	6.5	6	7.8	**1.75**	6	6.60	30.00	**1.17**	0.18
Variable 9	10	9	-	10	7	10	9	9	10	-	10	8	9.5	9	10	**1.00**	10	9.20	**90.00**	**1.03**	0.11
Variable 10	7	8	-	9	8	6	8	9	7	-	6	8	8	7	8	**1.00**	8	7.60	**60.00**	**1.07**	0.14

More specifically, although the 66.67% of respondents evaluate the 'variable 4' as 'highly important' (i.e. value this variable between 8 and 10 in the Likert scale), its interquartile range is 2.5 and its standard deviation over 1.5. Thus, how can we infer that this variable reaches consensus? Respectively, 'variable 7' has an interquartile range 2 and standard deviation 1.40, but only a 50% of respondents consider the variable as 'highly important' (its average value is 7.17). Similarly, 'variable 8' also has an unsatisfactory average value of 6.75 and an even lower percentage of respondents evaluate it as 'highly important' (41.67%), although its interquartile range is 2.25.

All things considered, in this example, only 4 variables could be thought of as reaching consensus (variables 1, 2, 3, 5) from the 1st Delphi round and a 2nd round of feedback is considered necessary in order to conclude for the most important variables.

For this reason, a questionnaire of a controlled feedback of the group's perspective should be designed, for the second Delphi round, so that the respondents can clarify or change their views. For this reason, the interquartile range of each variable should be identified (the shadow area in appendix 2) and the respondents should change or state their answer when this is out of this range.

In case where fewer respondents than in the first round participate, the response rate must be calculated. In this case example, we consider the answers of 10 out of 12 experts participating in the second round; a response rate of 83.33%.

As it is apparent, the second round has improved the agreement among the experts. This means that, apart from variables 1, 2, 3 and 5, consensus is also reached for the importance of variables 4, 7, 9 and 10 (see table 3). More specifically, all these variables satisfy the criteria of an interquartile range below 2.5, a standard deviation below 1.5 and a percentage of experts over 51% evaluating them as 'highly important' (between values 8-10). Hence, in this example, where the importance of 10 variables was investigated and diverse views existed (lack or agreement), the Delphi technique provided us with a reliable way to conclude to the most significant ones; namely these where agreement was reached among the experts.

Table 3: Variables' consensus

	% 8-10		IR		SD	
	1st Round	2nd Round	1st Round	2nd Round	1st Round	2nd Round
Variable 1	**83.33**	**100.00**	**1.25**	**0.75**	**1.06**	**0.74**
Variable 2	**100.00**	**100.00**	**0.25**	**1.00**	**0.45**	**0.52**
Variable 3	**91.67**	**100.00**	**1.00**	**1.00**	**0.89**	**0.67**
Variable 4	**66.67**	**60.00**	2.50	**1.00**	1.78	**1.43**
Variable 5	**91.67**	**100.00**	**1.25**	**1.00**	**1.27**	**0.71**
Variable 6	41.67	30.00	3.25	**1.75**	2.22	1.71
Variable 7	50.00	**60.00**	**2.00**	**1.75**	**1.40**	**1.25**
Variable 8	41.67	30.00	**2.25**	**1.75**	1.54	**1.17**
Variable 9	**83.33**	**90.00**	**2.00**	**1.00**	1.73	**1.03**
Variable 10	50.00	**60.00**	**2.00**	**1.00**	1.83	**1.07**

5.3 2nd Case

In this second case, an example of eliciting consensus upon the agreement of experts in 8 statements is provided, using a 5-Likert scale, with value 1 denoting strongly disagreeing and value 5 strongly agreeing (Hackett et al., 2006; Verhagen et al., 1998). This use of Delphi is presented, for instance, in Miller's (2001) study to ascertain the opinion of experts on indicators considered to measure the movement towards sustainable tourism. For this reason, he asked the experts whether they agree or not that an indicator is understandable or is measured on an ongoing basis etc. In these statements, experts were asked to provide their opinion choosing a value from 1 (strongly disagree) to 5 (strongly agree).

In such a case, the consensus is proposed to be assessed using three measures combinatory:

(i) The 51% of experts responding to the category 'strongly agreeing' (which according to Hackett et al., 2006, is between values 4 and 5 on a 5-Likert scale),
(ii) the interquartile range below 1 (Raskin, 1994; Rayens & Hahn, 2000: 311) and
(iii) the standard deviation below 1.5 (Christie & Barela, 2005)

Table 4: Delphi results regarding the agreement of the statements

	1st Expert	2nd Expert	3rd Expert	4th Expert	5th Expert	6th Expert	7th Expert	8th Expert	9th Expert	10th Expert	11th Expert	12th Expert	**median**	**Q1**	**Q3**	**Q=Q3-Q1**	**mode**	**average**	**8-10%**	**standard deviation**	**CV**
1st Delphi round																					
Statement 1	5	5	5	5	4	5	4	5	5	5	4	5	5	4.8	5	**0.25**	5	4.75	**100.00**	**0.45**	0.10
Statement 2	5	5	5	5	4	4	5	5	5	4	4	4	5	4	5	**1.00**	5	4.58	**100.00**	**0.51**	0.11
Statement 3	3	4	5	5	4	4	5	4	3	4	2	5	4	3.8	5	1.25	4	4.00	**75.00**	**0.95**	0.24
Statement 4	5	5	5	4	5	3	5	5	4	5	5	5	5	4.8	5	**0.25**	5	4.67	**91.67**	**0.65**	0.14
Statement 5	5	5	2	5	3	2	3	2	5	5	1	2	3	2	5	3.00	5	3.33	41.67	1.56	0.47
Statement 6	4	5	4	4	3	3	4	5	3	4	3	5	4	3	4.3	1.25	4	3.92	**66.67**	**0.79**	0.20
Statement 7	3	4	2	4	3	4	3	4	2	3	2	4	3	2.8	4	1.25	4	3.17	41.67	**0.83**	0.26
Statement 8	4	5	3	4	4	3	4	5	2	3	3	4	4	3	4	**1.00**	4	3.67	**58.33**	**0.89**	0.24
2nd Delphi round																					
Statement 1	5	5	-	5	4	5	4	5	5	-	4	5	5	4.3	5	**0.75**	5	4.70	**100.00**	**0.48**	0.10
Statement 2	5	5	-	5	4	4	5	5	5	-	4	4	5	4	5	**1.00**	5	4.60	**100.00**	**0.52**	0.11
Statement 3	3	4	-	5	4	4	5	4	4	-	3	5	4	4	4.8	**0.75**	4	4.10	**80.00**	**0.74**	0.18
Statement 4	5	5	-	5	5	4	5	5	5	-	5	5	5	5	5	**0.00**	5	4.90	**100.00**	**0.32**	0.06
Statement 5	5	5	-	5	3	2	4	2	5	-	2	2	3.5	2	5	3.00	5	3.50	50.00	**1.43**	0.41
Statement 6	4	5	-	5	4	3	4	5	5	-	5	5	5	4	5	**1.00**	5	4.50	**90.00**	**0.71**	0.16
Statement 7	3	4	-	4	3	4	3	4	3	-	3	4	3.5	3	4	**1.00**	3	3.50	50.00	**0.53**	0.15
Statement 8	4	5	-	5	4	3	4	5	4	-	3	4	4	4	4.8	**0.75**	4	4.10	**80.00**	**0.74**	0.18

To prove the need of this combinatory use, the answers of 12 experts for the 1st Delphi round and 10 experts for the 2nd one are provided (table 4).

As it is obvious, in the first Delphi round, there may be statements with standard deviation below 1.5 and/or a 51% or experts responding to the category 'strongly agreeing' (i.e. between values 4 and 5), while their interquartile range may be above 1 (statements 3 and 6). Respectively, there may be a case where the percentage of experts' responses lying into the 'strongly agreeing' category is below 51%, even if the standard deviation and/or the interquartile range are below 1.5 and 1 respectively (statement 7).

The question of how can one assure that these statements are reaching consensus among the experts still exists. Thus, combining the above three measures, in our example, only 4 statements could be thought of as overall consensus and a second round of enhancing agreement is required (see appendix 2).

In the second round of changing or stating the opinion (using the interquartile range as guidance), the level of agreement of two more statements was improved. That's was because the combination of the three measures of consensus, namely the 51% of experts responding to the 'strongly agreeing' category, the interquartile range below 1.5 and the standard deviation below 1, were denoting overall consensus among six statements. Obviously, consensus was reached in addition to statements 3 and 6, where their interquartile range value was improved to 0.75 and 1 respectively.

Finally, table 5 denotes the difference between these measures from round to round for each statement. Undoubtedly, the combinatory use of these three measures ensured, once more, the way of reaching consensus in Delphi technique and provided a reliable manner to conclude on the expert's overall agreement upon the eight statements assumed.

Table 5: Statement's consensus

	% 4-5		IR		SD	
	1st Round	2nd Round	1st Round	2nd Round	1st Round	2nd Round
Statement 1	**100.00**	**100.00**	**0.25**	**0.75**	**0.45**	**0.48**
Statement 2	**100.00**	**100.00**	**1.00**	**1.00**	**0.51**	**0.52**
Statement 3	**75.00**	**80.00**	1.25	**0.75**	**0.95**	**0.74**
Statement 4	**91.67**	**100.00**	**0.25**	**0.00**	**0.65**	**0.32**
Statement 5	41.67	50.00	3.00	3.00	1.56	**1.43**
Statement 6	**66.67**	**90.00**	1.25	**1.00**	**0.79**	**0.71**
Statement 7	41.67	50.00	1.25	**1.00**	**0.83**	**0.53**
Statement 8	**58.33**	**80.00**	**1.00**	**0.75**	**0.89**	**0.74**

6 CONCLUSION

The Delphi technique is a qualitative tool, which is used to elicit expert's opinion, without the cost of 'face-to-face' interaction, when information about the existing problem is restricted. Although time consuming, it is quite simple in application and allows interaction. However, its implementation on different sectors has also yielded issues of fuzziness regarding the expert's panel selection (size and characteristics), the consensus measurement and the number of rounds, as well as the response rate and the questionnaire design.

This paper clarifies the above issues both theoretically and practically, to assist any researcher in management or business field to conduct Delphi technique. In particular, through literature review this study shows that the purpose of each study defines the questionnaire design, and more specifically the Likert scale choice, while the homogeneity of the sample determines the panel size and therefore the Delphi rounds; demanding, in any case, a response rate above 70%. However, since there is a great variation among the studies using Delphi, regarding the Likert scale, the number of participants, the number of rounds and the measures of consensus, 32 prior empirical studies are analyzed to show the major trends.

On the other hand, using two examples, the way of reaching consensus was demonstrated in practice, leading to the need of using more than one statistical measures in order to assess the consensus. Hence, this study shows that there are cases where the interquartile range or/and the standard deviation may be within the accepted limit but the average value may be low and hence the experts may do not assess the importance of a variable as high (between values 8-10 in a 10-Likert scale) or may not 'strongly agree' with a statement (between values 4-5 in a 5-Likert scale). For this reason, these three measures should be considered at the same time, so that consensus can be ensured.

All things considered, Delphi is a quite useful tool in decision making process in the scientific field of management or business, when a lack of agreement or incomplete knowledge is evident. It is useful in case study analyses, because of its limitation of non generalizability of the results, and provides a great advantage for

the researcher who does not need a representative sample to implement this method. Its diffusion and contribution in any scientific field could be the aim of a longitudinal study. This means that, selecting the applications of Delphi from the very first years, such a study could highlight the scientific field with the greatest contribution and practical implementation. Undoubtedly, this is not the only implication for future studies, since an open case is the great time that this method demands in order to reach consensus. This issue may also be central in the near future, where technology could provide a clear assistance on its implementation. Hence, what was an obstacle in 1970s, could now be confronted through on-line applications, providing friendlier environment and quicker responses with real time interactions between the experts.

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APPENDIX 1

1st Delphi round: Questionnaire sample

Clarifications

In the following questionnaire your may state your opinion regarding the level of each variable's importance, compared to the others, by choosing a value among 0 to 10. More specifically, you may choose the zero (0) value when the variable is considered unimportant and, while value ten (10), when it is considered as highly important. Respectively, you should express your opinion on 8 statements by choosing a value among 1 to 5. You may choose value one (1) when you highly disagree, while value five (5) when you highly agree.

	Arithmetic scale											
	Not Important → Highly important											Answer
VARIABLES												
Variable 1	0	1	2	3	4	5	6	7	8	9	10	
Variable 2	0	1	2	3	4	5	6	7	8	9	10	
Variable 3	0	1	2	3	4	5	6	7	8	9	10	
Variable 4	0	1	2	3	4	5	6	7	8	9	10	
Variable 5	0	1	2	3	4	5	6	7	8	9	10	
Variable 6	0	1	2	3	4	5	6	7	8	9	10	
Variable 7	0	1	2	3	4	5	6	7	8	9	10	
Variable 8	0	1	2	3	4	5	6	7	8	9	10	
Variable 9	0	1	2	3	4	5	6	7	8	9	10	
Variable 10	0	1	2	3	4	5	6	7	8	9	10	
	Highly Disagree → Highly agree											Answer
STATEMENTS												
Statement 1	1			2			3		4		5	
Statement 2	1			2			3		4		5	
Statement 3	1			2			3		4		5	
Statement 4	1			2			3		4		5	
Statement 5	1			2			3		4		5	
Statement 6	1			2			3		4		5	
Statement 7	1			2			3		4		5	
Statement 8	1			2			3		4		5	
Additional information – observations:												

APPENDIX 2

2nd Delphi round: Questionnaire sample

Clarifications

In the following questionnaire you are to restate your opinion regarding the contribution level of each of the 10 variables, compared to the others, by choosing a value between 0 and 10 and your disagreement or agreement upon the 8 statements, by choosing a value between 1 and 5. In addition, the shadowed cells depict the range of the 50% of the first Delphi round responses as follows: the lower values imply lower importance for this specific variable or low levels of agreement, while the higher values, higher importance or higher levels of agreement.

In the two next tables, you are to restate your opinion, either by maintaining or changing your previous choice (your answer in 1st Delphi round). In the case where the chosen value is outside the shadowed range, you should justify your choice providing a short explaining text.

		Arithmetic scale											Answer	Stating your answer
		Not important → Highly important												
VARIABLES														
1	Variable 1	0	1	2	3	4	5	6	7	8	9	10		
2	Variable 2	0	1	2	3	4	5	6	7	8	9	10		
3	Variable 3	0	1	2	3	4	5	6	7	8	9	10		
4	Variable 4	0	1	2	3	4	5	6	7	8	9	10		
5	Variable 5	0	1	2	3	4	5	6	7	8	9	10		
6	Variable 6	0	1	2	3	4	5	6	7	8	9	10		
7	Variable 7	0	1	2	3	4	5	6	7	8	9	10		
8	Variable 8	0	1	2	3	4	5	6	7	8	9	10		
9	Variable 9	0	1	2	3	4	5	6	7	8	9	10		
10	Variable 10	0	1	2	3	4	5	6	7	8	9	10		

		Arithmetic scale					Answer	Stating your answer
		Highly disagree → Highly agree						
STATEMENTS								
1	Statement 1	1	2	3	4	5		
2	Statement 2	1	2	3	4	5		
3	Statement 3	1	2	3	4	5		
4	Statement 4	1	2	3	4	5		
5	Statement 5	1	2	3	4	5		
6	Statement 6	1	2	3	4	5		
7	Statement 7	1	2	3	4	5		
8	Statement 8	1	2	3	4	5		