Delphi Technique Theoretical Framework in Qualitative Research

[1,] Arash Habibi, [2,] Azam Sarafrazi, [3,] Sedigheh Izadyar

[1,] Master of Business Administration, Isfahan University, Iran
[2,] Master of EMBA, Payam Noor University, Iran
[3,] Master of Marketing Management, Guilan University, Iran

---**ABSTRACT**---

Using specialized knowledge and perspectives of a set in decision-makings about issues that are qualitative is very helpful. Delphi technique is a group knowledge acquisition method, which is also used for qualitative issue decision-makings. Delphi technique can be used for qualitative research that is exploratory and identifying the nature and fundamental elements of a phenomenon is a basis for study. It is a structured process for collecting data during the successive rounds and group consensus. Despite over a half century of using Delphi in scientific and academic studies, there are still several ambiguities about it. The main problem in using the Delphi technique is lack of a clear theoretical framework for using this technique. Therefore, this study aimed to present a comprehensive theoretical framework for the application of Delphi technique in qualitative research. In this theoretical framework, the application and consensus principles of Delphi technique in qualitative research were clearly explained.

Keywords - Delphi Technique, Qualitative Research, Theoretical Framework

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I. INTRODUCTION

Delphi is a name of temple in ancient Greek, which is the origin of Apollo's divine inspirations, god of sun and music. Greeks and ancient nations came in Pythia, the goddess of Delphi temple to predict the future [1] [2]. The Delphi technique was originally proposed based on people's conjecture, judgment, and inspiration but gradually took the academic form. For the first time in the late 1950s, in a research by U.S. RAND Corporation, the Delphi was introduced for the scientific study of experts' opinions on military defense project. However, for the security reasons, this technique was not proposed over ten years and in 1963, Dalkey and Helmer introduced it [3] [4]. Its first non-military use was suggested for economic development planning [5] [6] [7] .This technique gradually found its place in the academic studies but from the mid-90s, it became highly popular. Landeta's study indicated that since 1995 to 1999 a total 444 articles on this technique have been published in "Science Direct" and "ABI / Inform" journals. Since 2000 to 2004, this number has increased to 667 articles [6]. Among the various features of the Delphi technique, its four features are usually unchanged including anonymity, iteration, controlled feedback, and statistical "group response" [8] [9] [10].

Most researchers have used all [11] or some [12] [13] of the definition set out by Linstone and Turoff (1975) who define the Delphi technique as " a method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem" (p. 3) [14]. The main purpose of the Delphi method is 'to acquire the most reliable consensus of a group of experts' opinion by 'a series of intensive questionnaires combined with controlled opinion feedback' (p. 458) [15]. By obtaining the consensus of a group of experts using the process, researchers can identify and prioritize issues and develop a framework to recognize them [16] [2]. Hasson et al. (2000) argued that modified Delphi, policy Delphi, and real-time Delphi have all been used, while there are many potential types of Delphi techniques [17]. Three broad categories are generally in use and these are classical, policy and decision [18]. The Delphi technique is applied as a tools and method for consensus building using a series of questionnaires for data collection from a panel of selected participants [15] [19] [14] [20] [21] [22].

Undoubtedly, the collective wisdom in decision-making can lead to more complete and comprehensive decision-making. However, the group problem solving through traditional consensus method is associated with numerous difficulties. The group members who have high self-confidence are dominating the weaker members. Some are also pressured to conform to group comments and or because they respect other people, they do not express their opinions. Hence, a group problem solving approach will be often futile and ineffective. The anonymity principle is used to solve this problem. In Delphi technique, the experts and people who are used the survey do not know each other. Anonymity ensures overcoming the obstacles of groupthink [23] [24] [25] [1] [26]. A coordinator collects the experts' opinions and then he/she provides other members with the summarized results. Then, based on the summarized results in the previous step, individuals again adjust and express their opinions. Finally, after reaching a consensus, the results are discussed in terms of a statistical report (usually mean or median) and are used for decision-making [9] [27] [28].

The Delphi technique is a research approach to gain consensus using a series of questionnaires and the provision of feedback to participants who have expertise in key areas. The main problem in using the Delphi technique is the lack of a clear theoretical framework for using this technique. Therefore, this study aimed to present a comprehensive theoretical framework for the application of Delphi technique in qualitative research. In this theoretical framework, we clearly explain the application and consensus principles of Delphi technique in qualitative research.

II. DELPHI TECHNIQUE THEORETICAL FRAMEWORK

The major weakness of Delphi is the lack of a theoretical framework. Delphi as a research methodology has been variously presented as a survey, study, procedure, method, approach, polling, and technique [14] [29] [30] [31] [24] [25] [32] [33] [11] [34] [35] [36] [37] [38]. Nevertheless, it is generally acknowledged that the Delphi methodology is not uniform in its application [17] [1]. In addition, there are always ambiguities about the application requirements, panel size, how to select the panel, and recognizing the end of Delphi stages. In this comparative study, a framework is presented for the application of the Delphi technique in the qualitative decision-makings.
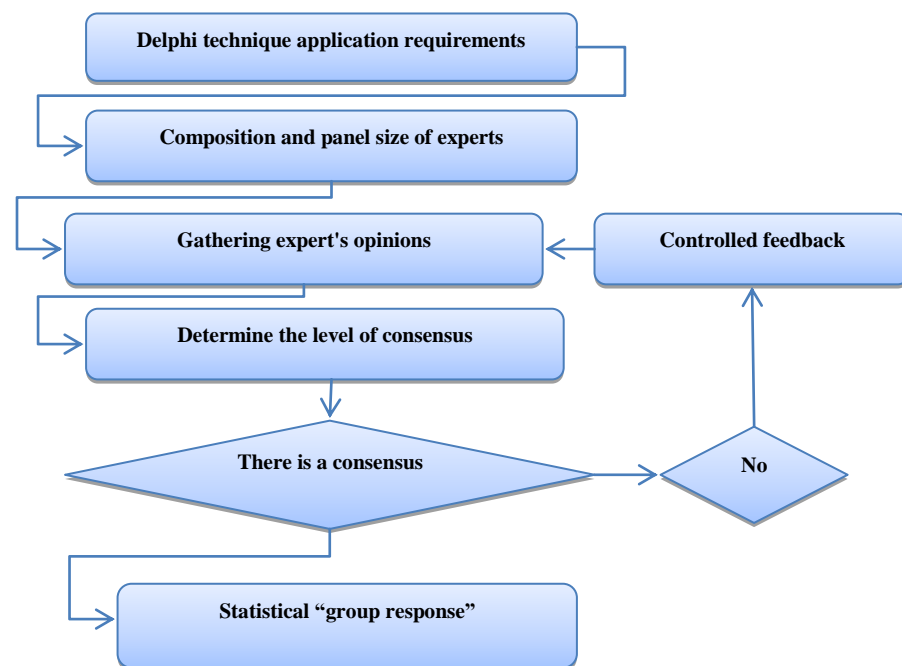
Fig 1. Theoretical framework of Delphi technique in qualitative research

2.1 Delphi Technique's Application Requirements

The most important requirements for the use of Delphi are the need for experts' judgment, group consensus to achieve the results, anonymity in data collection, a complex, multidimensional, and interdisciplinary problem, lack of consensus and imperfect knowledge, experienced and capable experts, dispersion of experts, no time limitation, and lack of cost-effective method [39] [6] [40] [28] [7] .

In qualitative research that is mainly based on the individuals' judgments and opinions, there is a prerequisite for using the Delphi method. If these studies are based on the expert opinions, then the use of inferential statistical techniques such as mean tests will not be justified. Since either experts are not so much that can be accessed wide samples of them or the time and cost to access them are difficult. In addition, to review the experts' opinions this proverb is truer: "you may know by a handful the whole sack".

Therefore, the two types of qualitative research should be distinguished to use the Delphi technique. Delphi technique can be used for qualitative research that is exploratory and identifying the nature and fundamental elements of a phenomenon is a basis for the study. Consider the problem of measuring customer satisfaction. If you were to examine the customer satisfaction, statistical sampling and inferential statistical methods would be used. However, if you decide to measure the customer satisfaction, then experts' opinions and the Delphi technique can be used. One of main application of Delphi technique is screening the items in operations research problems and of multi-criteria decision-making (MCDM) techniques.

2.2 Composition and Panel Size

Essentially, an accurate mechanism does not exist for identifying the number of individuals or the number of panels for inclusion in any individual study [41]. Although there are some disagreements about the composition and panel size of Delphi technique, a dominant pattern can be detected. It has been recommended that the panel size may vary according to the topics covered, the nature of different viewpoints included, and the time and money available [18] and it is also suggested to use a combination of individuals with multiple specialties and heterogeneous groups better than the homogeneous groups [1] [26]. Hsu and Sandford (2007) claimed that, ''Delphi subjects should be highly trained and competent within the specialized area of knowledge related to the target issue'' (p.4) [42]. Hogarth (1978) argued that between six and twelve members are ideal for Delphi technique and according to Clayton (1997), if a mixture of experts with different specialties is used, between five and ten members are sufficient (p. 5) [26]. While some Delphi studies considered fewer than 10 members in their panels [43] [44], other studies included more than 100 participants [45] [46].

Delphi panel is done with the participation of individuals who have the knowledge and expertise of the study subject. These people are known as the Delphi panel. One of the most important phases of Delphi technique is selecting eligible members for the Delphi panel because the validity of the results depends on the competence and knowledge of panel members [1]. In previous studies, Delphi has not recommended a specific method for sampling. Snowball technique can be used for sampling. The snowball sampling is one of the most common approaches of sequential sampling. This type of sampling is a non-probability method, which is also randomly selected. This method is suitable when the members of a group or community cannot be easily identified. In this method, the researcher first identifies some people and after receiving the information, he/she wants them to introduce other people [47]. This method can be also used to identify the experts in a particular field [48].

2.3 Gathering Expert Opinions

In qualitative research, which aims to determine the importance or screening of items, Likert scale can be used to gather the experts' opinions. Five-point or seven-point Likert scale is common. To develop five-point Likert scale, two "extremely agree" and "extremely disagree" linguistic scales are used at both ends of a spectrum. By defining the intermediate values, this scale can be developed and nine-point scales can be also used.

Diefenbach, Weinstein, and O'Reilly (1993) conducted an investigation of a range of Likert items, including 2-point, 5-point, 7-point, 9-point, 11-point, 12-point, and percentage (100-point) varieties [49]. Lewis (1993) found that 7-point scales resulted in stronger correlations with t-test results [50]. It was demonstrated that "no scale performed significantly better than the seven-point verbal category scale on any criterion" in the two studies carried out (p. 189) [49].
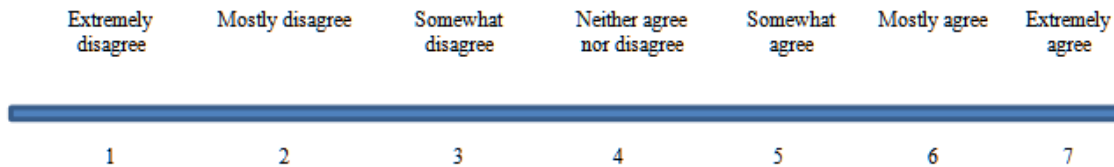
Fig 2. A five-point Likert scale [51]

Fig 3. A seven-point Likert scale [51]

After gathering the experts' opinions, the mean score of their opinions on each dimension is calculated. Given the theoretical framework, if there is no consensus, the experts will be provided with the calculated mean as a controlled feedback with questionnaire. After several rounds, when the consensus was achieved, based on the average of the final round, the items are screened. If nine-point scale is used, typically, the criteria with mean less than seven are removed. For seven-point and five-point scales, criteria with means lower than five and four are respectively removed.

2.4 Determining the Level of Consensus

Another problem with the Delphi technique is a scientific method for determining the level of consensus. A variety of methods has been proposed in different studies. Some researchers have determined Delphi rounds as a basis for reaching agreement. Between 2 and 10 rounds have been reported in various articles [53]. Fan and Cheng have believed that research has shown that three rounds are adequate for the Delphi technique [40]. Some also argued that the traditional Delphi contains four rounds that researchers have shortened it into two or three rounds to achieve the study's objectives [54] [5]. Such an approach is a target displacement. In fact, reaching a consensus is a basis for the end of Delphi rounds while in this approach doing a certain number of rounds is regarded as a basis for reaching an agreement. So, another solution must be identified to reach consensus. In a study, according to 114 articles about the Delphi technique, von der Gracht (2012) has presented 15 ways to achieve consensus [9].

Kendall's coefficient of concordance (Kendall's *W*), a consensus criterion representing the level of consensus between the participants [55] [56] [57], was calculated along with the mean rank and standard deviation. Kendall's coefficient of concordance ranges from 0 to 1, indicating the degree of consensus reached by the panel (strong consensus for $W > 0.7$; moderate consensus for $W = 0.5$; and weak consensus for $W < 0.3$) [58]. Kendall's coefficient of concordance is also a scale for determining the level of coordination and agreement between several ranks of *n* phenomenon. This scale shows a rank correlation between *m* ranking set. It can be used to determine the inter-judge reliability. Kendall's coefficient of concordance indicates that those who have ordered several categories according to their importance have used the same criteria to judge the importance of each category and in this regard, they agree to each other [57].
Kendall's coefficient is calculated as follows:

$$W = \frac{12S}{m^2(n^3 - n)} \qquad (1)$$

Where

$$S = \sum_{i=1}^{n} (R_i - \bar{R})^2$$

R_i = total ranks of a factor
m= number of rank sets or judges
n= number of ranked factors or phenomena

The value of this scale during the full coordination or agreement is one and in the absence of perfect coordination, it is zero. Schmidt (1997) proposed two statistical criteria to make decisions about stopping or continuing the Delphi rounds. The first criteria is a strong consensus among the panel members which is determined based on Kendall's coefficient of concordance. If there is no such a consensus, the constant coefficient or its negligible growth in two successive rounds shows that consensus has not been increased and the survey process must be stopped. Statistically significant coefficient *w* is not enough to stop a Delphi process. For panels with fewer than ten members, very small values of *w* are also significant [56].

III. CONCLUSION

To summarize, the Delphi technique is a research approach to gain consensus using a series of questionnaires and the provision of feedback to participants who have expertise in key areas. This method is especially useful when researchers need to collect ideas from isolated experts on a specific topic and establish agreement to discover the underlying assumptions or perspectives among the experts. However, the major weakness of Delphi is the lack of a theoretical framework. Delphi as a research methodology has been variously presented as a survey, study, procedure, method, approach, polling, and technique. Nevertheless, it is generally acknowledged that the Delphi methodology is not uniform in its application.

Although previous studies have always been disadvantaged by the lack of a theoretical framework for Delphi technique, considering numerous studies, access to a theoretical framework is simple. Given the findings of this study, it can be said that in qualitative research, it is recommended to use a group of ten experts with different specialties. The snowball sampling technique can also be used   to identify and select the sample. If the purpose is to summarize and screen an item set, a nine-point Likert scale can be used to gather the experts' opinions. Kendall's coefficient of concordance can be utilized to determine the agreement and end of the Delphi technique. Therefore, it can be concluded that the Delphi technique is an appropriate and acceptable mechanism to achieve consensus when developing sets of indicators.

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