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A Literature Review of Group Decision-Making: The Case Study of Delphi Method

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Abstract

The emergence of complex issues with insufficient information has led to the development of consensus methods, with the Delphi method being a prominent example. This study aimed to review related research to provide a comprehensive understanding of the method's characteristics, goals, implementation process, strengths, and limitations. The research methodology involved searching multiple academic databases, including Web of Science, Scopus, PubMed, ERIC, ProQuest, CIVILICA, and Google Scholar, using English and Persian keywords with no time restrictions up to June 2023.

A literature review reveals that the Delphi method is employed to systematically collect and synthesize expert opinions to reach a consensus on a specific issue, particularly when experts are geographically dispersed. The method is especially effective for addressing complex topics characterized by ambiguity, uncertainty, and limited empirical evidence. The key advantages of the Delphi technique encompass utilizing diverse communication strategies, facilitating comprehensive subject identification and understanding, and mitigating the potential bias and undue influence of individual personalities on collective group perspectives.

Despite its methodological robustness, the Delphi method encompasses several significant limitations that researchers must critically evaluate. These challenges include a protracted and resource-intensive process, potential inherent information source biases, risks of expert participant attrition, potential low response rates, participant methodological and topical fatigue, absence of standardized expert selection criteria, ambiguity in consensus definition parameters, and complexities surrounding optimal expert group composition. By meticulously understanding these methodological constraints and proactively developing strategic mitigation approaches, researchers can effectively leverage the Delphi technique to generate sophisticated, multi-dimensional insights and facilitate evidence-based, forward-looking decision-making processes.

Key Words: Advantages, Delphi Method, Group Decision-Making, Limitation.

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1- INTRODUCTION

Collective decision-making represents a collaborative process wherein a group of individuals collectively addresses a specific issue to optimize outcomes and achieve shared objectives (1). This approach involves two or more participants, each bringing unique perspectives, perceptions, attitudes, motivations, and personality characteristics, who collectively recognize and engage with a common challenge. Through this collaborative process, participants strategically navigate multiple potential solutions, seeking to develop a consensus-driven approach that reflects diverse individual preferences and collective insights (2-4).

The emergence of increasingly complex and nuanced challenges characterized by information insufficiency has catalyzed the development of sophisticated consensus methodologies. Among the most prominent consensus-generation techniques are interactive group approaches, the nominal group technique, the Delphi method, consensus development panels, and structured consultation processes (2, 3, 5-7).

This study aimed to systematically review existing literature to provide a comprehensive understanding of the Delphi method, critically examining its core characteristics, primary objectives, implementation processes, methodological strengths, and inherent limitations.

2- MATERIALS AND METHODS

In this comprehensive review, multiple academic databases and search platforms—including PubMed, Web of Science, Scopus, ProQuest, ERIC, CIVILICA, and Google Scholar—were systematically searched using English and Persian keywords. The search covered literature up to June 10, 2023, focusing on identifying articles about the Delphi method's processes, goals, advantages, and limitations.

The review methodology followed a rigorous approach involving independent, duplicate screening of full-text articles by two researchers, with any disagreements resolved by a supervisor. Relevant research findings were systematically categorized and presented using a narrative approach.

3-RESULTS

3-1. Delphi method

The Delphi method derives its name from the Oracle of Delphi in ancient Greece (8), symbolizing a profound approach to collective wisdom. First proposed by the Rand Corporation in the 1950s (9), this technique systematically collects and synthesizes opinions from qualified experts, particularly when participants are geographically dispersed (10).

Characterized by methodological versatility, the Delphi approach has been variously described as a technique, approach, survey, study, poll, consensus study, and method (2, 3, 11-15). At its core, it is a structured communication technique originally developed as a systematic, interactive forecasting method typically involving a panel of 5 to 10 experts (2, 3, 11-15).

Panel members can remain anonymous, with only the collective consensus being published (10). The method is extensively utilized in health-related domains such as clinical medicine, public health, and research to develop professional guidelines and reach expert consensus (16, 17). Unlike traditional surveys that focus on "what is", the Delphi method distinctively explores "what can/should be" (18).

Fundamentally, the Delphi method operates on the principle that collective group judgments are more valid and robust

than individual perspectives (8), providing a sophisticated mechanism for knowledge synthesis and strategic decision-making.

3-2. Types of Delphi

The Delphi method comprises three primary types of surveys: Policy Delphi, which focuses on developing strategies for specific problems; Classical Delphi, used for forecasting future trends; and Decision-Making Delphi, designed to optimize decision-making processes. These approaches provide structured methodologies for systematically collecting and synthesizing expert opinions across diverse domains (18, 19).

3-3. Characteristics of the Delphi method

The Delphi technique is distinguished by four key features that set it apart from other group decision strategies: anonymity, iterative feedback, group response, and expert consultation (20-24).

- **Anonymity**: This feature encourages participants to express their opinions freely and candidly by eliminating potential peer pressure (20-22). By removing direct interpersonal interactions, the method ensures more honest and unbiased responses.
- **Iterative Feedback**: The technique employs controlled feedback rounds, allowing panel members to gain a comprehensive understanding of collective perspectives (20, 21). This process enables participants to refine and adapt their responses based on insights from other experts.
- **Group Response**: Participants have multiple opportunities to modify and build upon shared information through successive feedback rounds (22, 23). This iterative approach continues until a robust consensus is achieved among the expert panel.
- **Expert Consultation**: Unlike random sampling, the Delphi method deliberately selects participants with specialized knowledge and expertise in the specific field under investigation, ensuring high-quality, informed insights (20-24).

These characteristics collectively enable the Delphi method to generate nuanced, consensus-driven outcomes across various research and decision-making contexts.

3-4. Objectives and application

While the Delphi method was initially developed to predict future trends (25), its applications have significantly expanded to encompass a broad range of strategic objectives. These include enhancing decision-making processes, improving judgment, facilitating problem-solving, conducting needs assessments, setting goals and priorities, stimulating creativity, organizing group communication, gathering collective information, training respondent groups, determining policies, specializing resources, and ultimately achieving consensus or group agreement (18, 19).

3-5. Number of specialists

The selection and number of specialists in the Delphi method lack a definitive, universal rule, with participant count depending on factors such as sample characteristics, research objectives, problem scope, and available resources. Studies typically involve 15-20 participants, though reported numbers range from 10 to over 2,000, with homogeneous groups often requiring 10-15 participants and heterogeneous samples preferred for capturing diverse perspectives. While larger sample sizes can introduce complexity in data collection and analysis, they also provide more comprehensive insights and increased confidence in findings. Some experts suggest 30 participants are sufficient, arguing that additional participants merely repeat existing information, though

empirical evidence about the impact of participant numbers on consensus trustworthiness remains limited (18, 19, 25-33).

3-6. Ethical considerations

Ethical considerations in the Delphi method closely parallel those of survey and questionnaire research. The primary ethical imperative is preserving participant anonymity, ensuring that individual responses are not disclosed in an identifiable manner. While anonymity is a core principle, practical challenges exist in verifying the complete confidentiality of the process. Researchers cannot definitively control whether participants discuss their involvement with others or guarantee that responses are entirely independent and uninfluenced by external factors. This inherent limitation underscores the importance of maintaining rigorous ethical standards throughout the research process (18, 33, 34).

3-7. Advantages of the Delphi consensus method

The Delphi method is a powerful technique for collecting expert insights, offering numerous significant advantages:

- **Structured Communication System:** The systematic approach and controlled feedback ensure a conclusive outcome, enabling the group to reach a consensus that accurately addresses the research question with high precision (22, 23).
- **Anonymity for Unbiased Responses:** Participants provide anonymous responses, eliminating fear of judgment or repercussions. This anonymity encourages more honest, candid, and authentic contributions (20, 33).
- **Geographical Flexibility:** The method transcends geographical limitations, allowing global expert consultation across diverse fields, markets, and locations. This approach enables access to a broader, more varied pool of expertise (26, 27).
- **Neutralizing Dominant Individual Influence**
- By using anonymous responses and avoiding lengthy in-person discussions, the Delphi method ensures each participant's voice is weighted equally. This approach mitigates potential biases introduced by dominant personalities in group dynamics (6, 49).
- **Time and Cost Efficiency:** Utilizing online tools reduces expenses associated with traditional research methods, such as travel and venue costs. The controlled feedback process eliminates time-consuming discussions, providing greater flexibility and expert accessibility (42, 51).
- **Additional advantages include:**
  - Repeated testing of answers until consensus is reached
  - Ease of learning and implementation
  - Resistance to individual opinion manipulation.

These characteristics make the Delphi method a robust, versatile research technique for generating comprehensive, consensus-driven insights (35-52).

3-8. Disadvantages of the Delphi consensus method

As with any research methodology, the Delphi method has inherent disadvantages, including:

- **Limited Open Discussion**: The Delphi technique employs controlled feedback, which means participants (questionnaire responders) cannot openly discuss ideas or elaborate on their perspectives as comprehensively as in other research techniques. While a small steering group of experts within the study design helps mitigate this limitation, the method's structured approach remains restrictive.

Consequently, the Delphi method may be less effective when addressing topics with highly polarized opinions, potentially necessitating additional research methods for deeper investigation (41, 52).

- **Requiring Commitment in Multiple Rounds:** The Delphi method often demands participants engage in multiple questionnaire rounds, which may include repetitive or similar questions. This repeated engagement can potentially lead to participant fatigue, disengagement, or reduced response rates, ultimately impacting the study's result magnitude and quality. Well-designed Delphi studies anticipate and strategically address this challenge by implementing techniques to maintain participant motivation and minimize dropout rates (42, 49).
- **Dependence of Study Interpretation on Responders' Expertise:** The Delphi method is frequently employed in scenarios lacking definitive answers, where participant opinions represent the primary data source. Consequently, the study's validity critically depends on the qualifications, experience, and expertise of the respondent group. Without a high-confidence level of participant competence, reaching substantive conclusions or actionable recommendations becomes challenging. Effective study design and rigorous participant selection processes are essential to mitigate this potential limitation, ensuring the research generates meaningful and credible insights (20, 22, 24, 50, 52).
- **A Rather Long and Tedious Process:** The Delphi method is characterized by a complex and time-consuming research approach that demands meticulous participant selection and questionnaire preparation. The structured methodology can inadvertently constrain respondents within predefined research frameworks, potentially limiting genuine insights. Researchers have critiqued the technique for potentially generating consensus through participant pressure rather than authentic agreement, where individual characteristics significantly influence outcomes. Moreover, the method risks marginalizing potentially valuable minority perspectives by prioritizing majority opinions. Since the technique fundamentally relies on subjective expert opinions, consensus does not guarantee accuracy. The process suffers from limited internal validity, making result reliability challenging to establish. Additionally, the Delphi technique's dependence on expert responses inherently makes it a slow research method, with data collection and analysis potentially spanning extended periods (26, 41, 33, 52).

3-9. Carrying Out the Delphi Method

The Delphi method is a systematic process that involves gathering insights and opinions from a panel of experts to reach a group consensus on a specific topic (7, 9, 20). Implementing the Delphi method process is broadly defined in four key steps (22, 26, 52, 53).

Step 1: Defining the Objectives

The first step is to define the objectives and scope of the Delphi study clearly (24, 50). Determining the specific questions or topics that need expert input and identifying the key issues to be addressed are essential (18, 31). This step lays the foundation for the entire process and ensures that the study remains focused and relevant (22, 47).

Step 2: Selection of Experts

Selecting the right panel of experts is crucial for the success of the Delphi technique (47, 54). Experts should possess

the knowledge, expertise, and experience related to the topic under investigation (20, 22). The panel should be diverse enough to provide a comprehensive range of perspectives (41, 52). The number of experts can vary depending on the scope and complexity of the study, but it is generally recommended to have at least 10-15 participants (33, 49).

Step 3: Elaboration and Launching of Questionnaires

This step involves creating questionnaires to gather input from the experts (42, 51). The questionnaires can be structured, semi-structured, or open-ended, depending on the objectives of the study (19, 46).

- **Round 1**: In the initial round, an open-ended questionnaire is distributed to all experts. Each expert responds independently, providing their insights, predictions, or suggestions related to the defined objectives (11, 12).
- **Round 2**: After collecting the responses from Round 1, the facilitator summarizes and compiles the expert opinions without revealing individual identities (16, 23). The summary is then used to create a more focused and structured questionnaire for the next round (27, 42).
- **Subsequent Rounds (Optional):** Depending on the level of consensus achieved in each round, additional rounds can be conducted to refine the opinions further (33, 49).

Step 4: Using the Results

Once the Delphi process is concluded and a consensus is reached, the results can be analyzed and used for decision-making, forecasting, policy development, or any other purpose defined in the study's objectives (20, 52). The anonymized nature of Delphi studies helps ensure that the outcomes are unbiased and represent the collective wisdom of the experts (6, 16).

3-10. Continuous Communication and Feedback

Throughout the Delphi process, continuous communication with the experts is essential. Regular updates, reminders, and clarifications may be necessary to ensure high participation and engagement from the panel members. The facilitator plays a crucial role in managing the process, collating responses, and providing feedback to the participants (7, 18, 48, 53-59).

3-11. Comparison of the Delphi Method with Other Research Methods

Research techniques play a vital role in gathering data, analyzing information, and drawing conclusions (20, 22, 26). When obtaining expert opinions and insights, the Delphi technique is often compared with other research techniques (41, 52, 54).

Delphi Method vs. Expert Panels: The Delphi method engages a diverse panel of experts from various fields to reach a group consensus on a specific topic, often involving anonymity and iterative feedback (7, 16, 23). Expert panels, in contrast, involve gathering experts to provide individual opinions on a subject without anonymity or iterative feedback (33, 42, 47).

Comparison: While both approaches involve expert insights, the Delphi method's unique anonymity and iterative approach reduce bias and encourage more candid responses (6, 8, 41). The structured, multi-round process allows participants to refine their perspectives based on aggregated group feedback, distinguishing it from traditional expert panel methodologies (27, 52, 54).

Delphi Method vs. Surveys: The Delphi method utilizes iterative questionnaires to collect expert opinions, allowing participants to revise their responses based on group feedback (7, 16, 23). Surveys involve distributing questionnaires or

interviews to a larger sample, typically aiming for quantitative data collection (42, 46, 51).

Comparison: The Delphi method focuses on qualitative data collection and expert consensus (20, 22, 52), while surveys aim for broad data collection and statistical analysis (4, 10, 19). The Delphi method allows for the exploration of complex issues and expert insights, while surveys are more suitable for descriptive and statistical analysis (6, 41, 47).

Delphi Method vs. Focus Groups

The Delphi method involves collecting opinions and feedback from a selected panel of experts anonymously through multiple rounds of questionnaires (7, 16, 20). Participants do not interact directly, ensuring unbiased responses (6, 8, 41).

Focus groups involve conducting group discussions with participants to explore their opinions, attitudes, and perceptions (60-62). Participants interact and discuss their views openly, creating a dynamic conversational environment.

Comparison: The Delphi method provides anonymity, reducing the influence of dominant personalities and minimizing groupthink (22, 47, 52). Focus groups, in contrast, foster face-to-face interactions and spontaneous discussions, allowing for in-depth exploration of ideas (6, 41, 52).

4- CONCLUSION

The Delphi method is a sophisticated collective decision-making approach designed to systematically gather and synthesize expert opinions on complex or uncertain topics. Distinguished by its unique methodology, the technique involves multiple iterative rounds of anonymous questionnaires, allowing participants to refine their perspectives based on aggregated group feedback.

Key characteristics of the Delphi method include anonymity, iterative feedback, and expert consultation. Unlike traditional research methods, this approach minimizes individual biases by preventing direct interaction between participants, thereby encouraging more candid and uninfluenced responses. The process typically involves carefully selected experts from diverse backgrounds, with panel sizes ranging from 15 to 50 participants, depending on the research objectives and complexity of the topic.

While the Delphi method offers significant advantages in generating consensus and exploring nuanced issues, it is not without limitations. Challenges include potential participant fatigue, time-consuming processes, and the risk of superficial consensus. Researchers must carefully design their studies, paying close attention to expert selection, questionnaire development, and interpretation of results to maximize the method's effectiveness in generating meaningful insights across various domains of research.

5- AUTHORS' CONTRIBUTIONS

Study conception or design: FB and KS; Data analyzing and draft manuscript preparation: BE, SS, RR, and KS; Critical revision of the paper: FB; Supervision of the research: FB and KS; Final approval of the version to be published: FB, BE, SS, RR, and KS.

6- CONFLICT OF INTEREST: None.

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