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## **Delphi technique between the easy theoretic and the difficulty application in scientific research and future studies**

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**Abstract.** The application of Delphi technique in scientific studies and future scientific research gave it a great importance according to the efficiency and effectiveness of its results. It is able to find solutions to any research problem by following the methodological steps during its application, starting with the selection of experts and identifying the problem studied carefully to the results or the final report that prepared by the researcher based on the opinions and expert ideas. This technique combines between quantitative and qualitative way. It is based mainly on questionnaires distributed from two to four phases as a maximum, which contain open questions in its first phase and closed ones in the rest of the stages. Through this paper we will try to explain this technique, the steps that are based on it with its advantages, disadvantages and the difficulties of its application with a typical example explaining how to apply them.

**Keywords.** Delphi Technique, Experts, Open Questionnaire, Closed Questionnaire, Future Studies

### **Introduction**

Future studies are in the process of being identified as a new academic field, and work, in this area, ranges from those based on mature mathematical methods and models to ones that rely on realistic practices that seek to create a better environment for life (Niiniluoto I, 2001, p.33). There are many qualitative or quantitative methods that depend on these research and studies, such as the Delphi technique, which are important to the research and future studies.

It is the most famous technique; that's why it's used in future studies on the medium or long term. It is based on a set of questionnaires which are opened in the first stage and closed in the other ones, until the consensus between the experts that are participating on the case studied.

This technique in our time become useful in many fields and sciences such as economic, social, political, etc., and even in the field of technology, urban planning and tourism because of its importance and usefulness that are confirmed by many studies are based on this technique to get proven results.

### **I. Methodology of Future Studies:**

Future or prospective studies are not methodologically independent of the rest of the science, but they share other sciences in their programs that take advantage of rapid

developments in various aspects of science and significant developments in the fields of computer science and technology, quantitative and qualitative methods (**Dnayef bin Rashid al-Jabri, p.7**).

According to the future approach, Al-Sayegh explains that the future studies are based on four hypotheses (**Al-Sayegh Abdel Rahman Ahmad, 1999, p.19**):

1. The future consists of three determinants such as historical variables and natural facts of the present data, human choices and some unexpected indicators, also the degree of contribution of any of the three determinants varies according to readiness and early work in the future.
2. Any period of time has many future alternatives, which can be achieved on the basis of historical variables and natural facts, but the unexpected effects in addition to the human choice of alternatives are the final picture of the future.
3. Conscious choice is made only by identifying all possible alternatives and exploring the consequences of selecting any of them.
4. Forward-looking studies are not intended to predict the future, but rather to elucidate the range of expected alternatives that help to make informed choices for a better future.

While **Nineloto** identified three tasks of the future researcher:

1. Building potential future alternatives.
2. Evaluate the probability of each alternative.
3. Evaluate the degree of desire and acceptance of each alternative.

## **II. Delphi Technique**

"Delphi technique" which is sometimes called "Delphi method" or "Delphi method" was named by an ancient Greek "the temple of Delphi" because some priests, wise men, and fortune-tellers used to practise their foresight in the future. (**A.Sergiev, 1978,P.79**), moreover, in the 1950s, Norman Dalkey and Olaf Helmer used it scientifically, systematically and in a deliberately way in the US Navy and continued until 1963 (**Pamila BAILLETTE et al, 2013,P.4**). Then, it started to spread and develop and is still used in many fields and studies which helped to find appropriate solutions to many problems and issues by selecting a group of experts and specialists in a particular field ", " The size of the sample usually varies from ten to eighteen (10 – 18) experts (**Imanbint Ali al-Maraisi 2006-2007, p. 109**). The term expert refers to "any person has practical, political, administrative knowledge of a specific subject and the capacity to translate these experiences by expressing his or her point of view on the subject of the study using this technique" (**ORSA – Lorraine, 2009, P.02**).

The Delphi technique is based on sending questions and questionnaires to the selected group of experts and in the light of their response, new questions are identified, usually from "two to three stages" (Jean-Pierre BootoEkionéa et al, 2011, P. 169). In order to obtain a relative agreement of opinion, there are two types of questionnaires adopted by this technique:

- Open questionnaires
- Closed questionnaires

### **II.1. Delphi Technique Concept:**

It is a method of collecting information or data. It includes a set of investigation procedures and aims to identify the agreed opinion among a carefully selected group. This group is characterized by its in-depth knowledge of the subject of the study (**Imanbint Ali al-Maraisi,**

p. 107). As a result, we have given to interested people and to specialists in the field of future studies, some definitions and concepts of this technique such as:

- **Rossman and Carey** defined Delphi as "a way to gather opinions and information from a group of intended participants, experts or others who have the ability to provide assistance in the problem."

Or it is a scientific a program or approach to explore the opinion of a group of experts on the subject of the study and the opinion is conducted through the discussion of others, but only known to their views and this is in more than one session to reach the results to solve the problem" (**Saif al-Islam Ali Matar, 1995 , P. 22**).

There is another definition of the Delphi technique: "a method or a way to group a number of experts that is difficult to gather around a discussion table, so that the communication allows each expert to solve the problem without being influenced by the group. "(**Nasser Mohammed al-Adaily, 1993, P. 134**).

And that "the method of collective governance and strategic decision-making is carried out through a number of surveys on a group of experts who are carefully selected according to specific criteria based on their scientific qualification and experience that enrich the subject of the study (**Abdel-Hafiz Ali, 1998, p. 73**).

It is also identified as "a method that combines between qualitative and quantitative research at the same time. The questionnaire designed to take experience from the study need requires a separate evaluation of questions on the subject. At the same time, the subject's expertise is available to add additional information about the subject. And hence, the combination of quantitative and qualitative methods is achieved at the same time "(**Al-Jaidi Khalid Saad, 2005, p. 48**).

The following table shows the comparison between the traditional survey and the Delphi technique

**Table (01): Comparison between traditional survey and Delphi technique**

<b>Evaluation</b>	<b>Traditional Survey Method</b>	<b>Delphi Method</b>
<b>procedures Summary</b>	The questionnaire is based on questions related to the subject of the study. Many questions related to the credibility of the questions must be taken into account by the researcher in order to design a good study. Questionnaires may collect quantitative data or how data, or both. The researcher must identify the community that wants to test his hypotheses, and then select a random sample from that community to apply the study.	The questionnaire is designed in the same way as the traditional survey method design, before the researcher chooses the group of qualified experts to answer the questionnaire, then analyze their answers. The researcher, then designs another survey, based on the responses of the first survey, and then executes it on the same group of respondents asking them to review their first answers and / or answer additional questions based on feedback from the respondents on the first survey. This process is repeated until a satisfactory degree of agreement is achieved, while the identities of the experts keep hidden from each other.
<b>Sample representation</b>	The researcher selects the sample representing with randomly way from the community of study.	A Delphi study is a group of experts brought together to answer difficult questions. Thus, Delphi's study can be considered as a type of

		meeting or group decision technique, although as a survey, it is not without complexity.
<b>Sample size for statistical strength and the significance of the results</b>	Because the aim is to generalize the results to a larger community, the researcher must choose a large sample enough to explore statistically relationships in the community of study.	The group size in the Delphi method does not depend on statistical criteria, but on the degree of interaction within the group to reach consensus among experts. Based on specialists in this field, the appropriate size of the group may be between 10 and 18 experts.
<b>Structural honesty</b>	The researcher seeks to ensure the honesty of the study structure by paying more attention to the design of the study and through tribal testing.	In addition to taking care of the design of the study and the tribal test, the Delphi method can use additional constructional means of honesty by asking the experts to review the researcher's interpretation and classification of the variables. This helps that the respondents are familiar with the researcher other than the other survey types.
<b>Richness of data</b>	Data richness depends on the format and depth of the questions, and the ability to follow-up respondents through the interview, for example, although this is limited because of the difficulty of follow-up.	Data richness in Delphi studies is subject to the same data richness standard in traditional surveys, but by nature, Delphi study data is richer because of repetition and review of responses, as well as easy follow-up of respondents.

**Source: Okoli, C. &Pawlowski, S, 2004, pp.15-29. &Dr. Nayef bin Rashid Al-Jabri, Prof. Kamal HusniBayoumi, et al., Pp. 14-16. With the treatment of the author.**

## **II .2. The importance of Delphi technique:**

The Delphi technique in the research or studies it has adopted is very important and can be summarized in the following points (Saâdi, 2011, pp. 4-5):

- Access to information through opinions, ideas and expert judgments.
- The information obtained is a compromise theme.
- Access to information covering all aspects of the subject.
- Participation of a group of experts in the process of forecasting and not relying on the opinion of one expert.
- Give the experts their opinions and ideas freely and clearly without prior condition.
- Delphi's technical ability to apply in many fields to suit any research problem.
- Ability to exclude anomalous views and reduce cost and loss of time and effort.
- Contribute to the development of solutions collected by experts for any research problem.

## **II.3. Methods of Delphi Technique:**

There are four methods of the Delphi technique. Most of the studies depending on this technique are:

### **II.3.1. Traditional image:**

This is the most common format in which a small team do the observation and controlling by designing the questionnaire or a survey of opinion about a subject in a given

field. The questionnaire is sent to a group of experts who send the answers to the observation team who coordinates and summarizes the results of the questionnaire. Then, a new questionnaire is developed for the same group that responded at the first time. At least, one person has the chance to review the previous responses and re-evaluate their views in the light of the results of the first questionnaire. The tours are repeated in the same way and may extend to three or four rounds (Yousef bin SayahNazal al-Bayali, 2007, p. 200).

### **II.3.2. Delphi method of decisions:**

"This image seeks to reach the decision-making of a particular area where the supervisor of the action team is doing certain actions that lead to the emergence of a particular prediction as the strongest possible predictions" (A. Khamisa, Akabi, 2017, p. 101).

### **II.3.3. Delphi policies:**

They're different from the previous method which is not seeking consensus among the group of experts, but seeking to discover basic trends and differences that would lead to subtract a group of alternatives or solutions to support the plans or policies on today's agenda (Abd Al-Karim Al-Zahrani, 2014, p.131).

### **II.3.4. Delphi Conference Method:**

"In this method, the performing team is replaced by a programmer computer so that it compiles the results and responses received for classification to reach general trends in the shortest time possible, thereby shortening the time." (A. Khamisa, Akabi, 2017, p. 101).

## **II.4. Properties and features of Delphi technique:**

Delphi presents a range of properties and features that have had a significant impact on the prospective studies adopted by Okoli, especially: (Okoli, C. & Pawlowski, S, 2004, p.18):

1. The Delphi technique does not require that the experts meet at the discussion table and this will overcome the difficulty of coordination to meet the group in one place and ensure the participation of individuals who are embarrassed from the group meeting or who do not have time.
2. The Delphi study sample is a panel of experts gathered together to answer difficult questions.
3. Research using Delphi technique requires the researcher to coexist with the studied group for long periods compared to the traditional survey method.
4. The researcher should perform large coordination roles during the use of this technique.
5. The sample size ranges from 10 to 18 experts.
6. Delphi research is characterized by high degree of structural honesty due to the researcher's knowledge of the respondents and the possibility of reviewing the responses with them.
7. Delphi's research is characterized by the disappearance of the problem of non-response or pulling out between sample members because the researcher calls the interviewees personally.
8. Delphi technique is rich in information because of the repetition and review of responses.

There are other advantages that complement what we mentioned earlier (Sultan Bin Ayed Al-Qarni, 2014, p. 138):

1. Delphi technology is flexible, combining intuitive and exploratory techniques.

2. The system analysis approach is used. There are inputs that come through the application of the questionnaires. There are outputs that are revealed by the results of the application. There is feedback by re-presenting the outputs in the form of inputs so that the expert sees his opinion in light of the opinions of others.

3. The use of statistics in the analysis of results, giving the results a greater objectivity and subject to statistical description.

4. Gathering comprehensive information from as many experts as possible without geographic difficulties.

5. Obtaining information about any complex, ambiguous or new phenomenon that is difficult to interpret.

6. The roster of experts may include names belonging to groups that are not harmonically defined.

7. The ability to apply Delphi technology in many areas to adapt to any problem.

8. Reduce cost, time, effort and increase the yield (Bahjat Attia Ramez, 1998, p.51).

Among the characteristics mentioned are those of "Trudi Lang", which summarized them in four main elements: "(A. Khamisa, Akabi, 2017, 97):

- **Structured questioning:** it is carried out through the use of questionnaires, which makes the study clearer and allows to control and guide.

- **Repetition:** the process by which the questionnaire is submitted to a number of rounds to enable participants to review their responses.

- **feedback:** verified through the responses of team members as well as a review of their responses, which means that all the reactions of the team are taken into consideration.

- **Confidentiality:** achieved by giving team members every freedom to create ideal questionnaires to express their opinions without feeling pressure from other teams.

#### **II.5. Delphi technical disadvantages:**

Any method or technique followed in the scientific research has a number of negatives or defects, but does not affect negatively the efficiency and richness of the results obtained when applied in different research and studies, multiple and varied, and proved their realness and the disadvantages that we can record on this technology identified by Enzer, Boucher and Lazer in 1971 (Iman bint Ali al-Maraisi, p. 109):

1. There is no confrontation in the debate.

2. 1. Respondents may not understand the content.

3. 1. It is possible for the participant to avoid understanding the subject.

4. 1. Slow system takes a long time.

The problem of time in Delphi technology remains even with the development of communication methods. Sending, receiving and analyzing one questionnaire using the latest technologies before submitting the second questionnaire requires at least one month (Okoli, C. & Pawlowski, S, 2004, p.18).

Among the disadvantages related to the tool are the following (Abdel-Hafiz Ali, 1998, p. 82):

1. **Formulation of the questionnaire:** It is very difficult to put questions and paragraphs clearly and unambiguously.

2. **Identification of the sample members:** Prior criteria must be established specifying the expert who must participate within the sample.

3. **Explanation and clarification:** Respondents do not have the opportunity to comment, clarify or question verbally.

### **II.6. Steps to use Delphi technique:**

For the best performance of the Delphi technique, a set of steps must be observed which directly contribute to the actual and real results of the study based on this technique. The most important ones are:

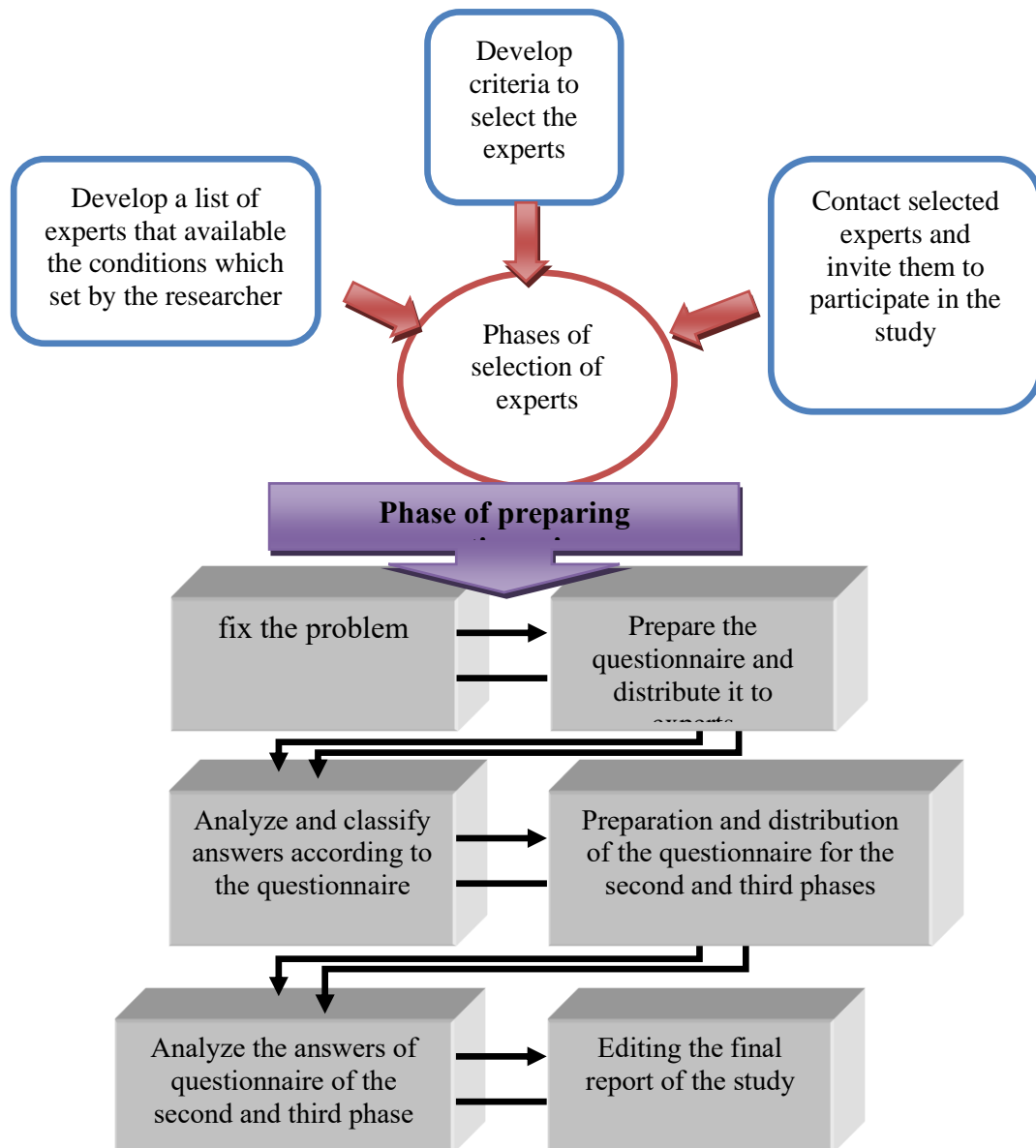
1. Determine the sample of the study from opinion experts and whenever there is a diversity of experiences it is the better.
2. Identify the problem by the researcher.
3. The questionnaire started from the first round of the Delphi technique by designing a list of questions and an open questionnaire according to the characteristics of the Delphi technique.
4. Check from the questionnaire to be sure from the language integrity and to avoid any ambiguity or confusion ([www.lit.Edu/it/delphi.Html](http://www.lit.Edu/it/delphi.Html) (12/05/2015)).
5. Distribution of the questionnaire to the list of experts selected by the researcher.
6. After receiving the questionnaire for the first course, the researcher analyzes the answers statistically and then rearranges the paragraphs based on this analysis and put them in another questionnaire for use in the second course (**Badr Ahmed, 1984, pp. 243-244**).
7. Distribution of this questionnaire to the same experts to review their answers according to the statistical analysis provided to them and the questionnaire at this course is closed based on the main characteristics of Delphi technique.
8. Analysis of the responses of the questionnaire for the second stage (in the case of non-consensus of experts on most of the points in this questionnaire. The steps are repeated again until consensus and consistency in the results of the study by the experts and at least the number of questionnaires according to the Delphi technique from two to four (2 – 4) stages as far as possible).
9. Analysis, presentation and preparation of the results of the study and the conclusion of the study by the researcher based on what the experts agreed.

### **II.7. The foundations of the success of Delphi technique:**

For the success of this technique, in the study carried out by the researcher, it is necessary to know the keys to the secret of its success when it is applied to the experts and to summarize it in the following points (**d. Mohammed Mujahid Zain al-Din, 2013, p. 22**):

1. The group of experts to whom the questionnaires are applied should not belong to any field of thought or discipline.
2. The researcher who uses the Delphi technique is highly precise, objectivity and far from biased until he reaches a kind of agreement in a comprehensive view of its case for discussion and research.
3. The researcher should allow sufficient time for the experts to express their points of view and use them in such a way so as to lead the expert neglect to answer the questionnaire or provide unreflecting information that may conduct to dishonest results.
4. Each expert does not know the other experts participating in the study.
5. Only the coordinator of the study knows the change of opinion of the expert(s).

**Figure (01): Steps to use Delphi technique:**



**Source : Jean-Pierre BootoEkionea et Al,2011. P .171, improved by the researcher**

### **II.8. Criteria for the experts' selection:**

Although the Delphi technique does not require a large sample of individuals, selecting the group of experts and ensuring their participation is another dilemma. It takes a lot of attention, as long as the data of the study is valid, which is not without complexity. (Okoli, C. &Pawlowski, S, 2004, p. 24).

Among the criteria to be taken into consideration in the process of selecting an expert are the following:

- **Degree:** The higher the scientific qualification of the expert masters, the more it enriches the study with solutions and hence, constructive ideas enrich the research under study.

- **Experience:** An important factor in enriching the study under discussion. The more expert experiences in the field of study specialization, the more effective and objective results due to the professional gains that he possesses in his field of specialization.

- **Employer side:** It is preferable to have a variety of workplaces to which the study members belong.

- **The intellectual and doctrinal diversity of experts:** This is mainly useful in the Delphi method of policy because it does not originally seek consensus but seeks to have multiple alternatives in the topic studied by the experts.

**Age:** plays an important role in enriching the study based on the Delphi technique: the more participation there is for different age groups, the more realistic and objective the results of the study are.

### **II.9. Delphi questionnaire development steps:**

#### **Phase I (Open Questionnaire):**

It is a question or a set of direct questions including the dimensions of the issue to be addressed, which are then sent to the experts or specialists selected in the group to share their opinion and analysis of the issue. a problem to which they are invited to respond and to express their points of view. The future in true freedom (**Dr .Mohammed Mujahid Zinedine, 2013, 25**).

There are two types of questionnaires in the Delphi technique that the researcher should know during the preparation of the first phase questionnaire in order to ensure the success of the study or research and to achieve a real and satisfactory results by the experts:

**Inductive questionnaires:** it provides experts with a direct question about the subject of research, and leaves them free to perform their perceptions around it.

**Conclusion questionnaires:** it provides experts with basic information and data on the subject of the research followed by a number of open questions, to comment on and evaluate them, in order to analyze them in the previous way and explain them to the experts again (**Dr. Mohammed Mujahid Zaidin, 2013, p70**).

#### **Phase II (closed questionnaire):**

It is prepared and submitted to experts after analysis of open questionnaire data, and presented to the experts more than once. However, in this type of questionnaire, the answers is defined as (yes - no) (agree - disagree) until the answers reach the degree of stability. that makes the researcher determine the relative value of each statement.

#### **Phase II (closed questionnaire):**

It is prepared and submitted to the experts after analyzing the data of an open questionnaire, then presented to the experts more than once. However, in this type of questionnaire, the answers are defined as follows: (yes - no) (agree – disagree) until the answers reach the degree of stability. that makes the researcher determine the relative value of each statement.

### **III. Difficulties in applying the Delphi technique:**

There are some difficulties that sometimes hamper the good conduct of the studies and research that use this technique and can be summarized in five principal elements inspired from the steps and processes of the applying of the Delphi technique (**Mansour Fahmi, 1988, p. 137**):

Certain difficulties sometimes hinder the smooth development of studies and research that have adopted this technique and can be summarized in five key elements inspired from the steps and processes of the applying of the Delphi technique (**Mansour Fahmy, 1988, 137**).

**1. For experts:**

- Difficult to identify and select experts.
- Sometimes the researcher tends to select some experts for personal or intellectual reasons.
- The withdrawal of certain experts at some stages of the study.
- Some experts don't hesitate to fill out the questionnaire.

**2. For researchers:**

- Lack of coordination with the expert.
- Lack of creativity and imagination from the researcher.
- Language weakness.
- Lack of experience and weak scientific ability on analysis and statistics.

**3. For the questionnaire:**

- Difficulty in filling the questionnaire
- The difficulty of putting the items of the case.
- Difficulty of drafting and definition.

**4. For the connection:**

- Difficult for the researcher to contact the experts, especially if they are in different geographical locations.
- Consumption of time despite the development in the field of communications.

**5. For implementation:**

- Failure to master the procedures and stages of technique by the expert or researcher.
- The researcher's inability to analyze, formulate and visualize alternatives during follow-up.

**Conclusion:**

The application of some techniques for prospective or future studies currently contributes significantly to finding solutions or alternatives, which contribute positively to good progress in some sectors or vital fields and in various disciplines. This has given many countries an important priority to these studies and allocated significant budgets and human resources to ensure the effectiveness and objectivity of the forward-looking studies carried out and adopted in all sectors by virtue of which it can define and shape its future policies and strategies.

The Delphi technique is one of the most effective techniques in the field of future studies and it has proven its effectiveness and efficiency in many fields such as economic, social, political, etc., and we can find solutions to the biggest dilemmas or problems with it in any subject or field of research. Despite some difficulties encountered the researcher or research institution during its application, in order to ensure the effectiveness and easy of application of this technique in practice, two basic conditions must be met:

- Selection of competent experts who can enrich the issue or the research problem by proposing a range of solutions and alternatives that serve this research.
- Design and analysis of questionnaires at all stages of the Delphi technique, requiring the ability and high efficiency of the researcher or the research institution, in the formulation of questions and analysis of the results at each stage through feedback nutrition until the final report, which is the summary of this study.

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