Using the Delphi Method for Futures Studies

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Abstract
Along with the experience and knowledge about the past, decision-makers use future projections and visions to make decisions for the future. They can do this intuitively but also with the help of methods such as forecasting and foresight. The Delphi method is one of the oldest techniques of eliciting responses and refining expert group decisions. Delphi process gives the participants objective feedback from structured group consensus. This paper addresses a challenging topic, which in both academic and professional literatures has been widely discussed, that is, How the Delphi method can contribute to the development of future study knowledge.

Keywords
Futures Studies, Delphi Method, Forecasting Technique.

1. Introduction
Futures studies is the study of postulating possible, probable, and preferable futures and the worldviews and myths that underlie them. In general, it can be considered as a branch of the social sciences and parallel to the field of history. Futures studies seeks to understand what is likely to continue and what could plausibly change. Part of the discipline thus seeks a systematic and pattern-based understanding of past and present. And to determine the likelihood of future events and trends (Andersson, 2018). Futures studies is an interdisciplinary field, studying past and present changes, and aggregating and analyzing both lay and professional strategies and opinions with respect to future. It includes analyzing the sources, patterns, and causes of change and stability in an attempt to develop foresight and to map possible futures. Around the world, the field is variously referred to as futures studies, strategic foresight, futuristic, futures thinking, and futurology. Futures studies and strategic foresight are the academic field’s most commonly used terms in the English-speaking world.

Foresight was the original term and was first used in this sense by H.G. Wells in 1932. “Futurology” is a term common in encyclopedias, though it is used almost exclusively by no practitioners today, at least in the English-speaking world.

Among various foresight approaches, the Delphi methodology has established a position as an effective tool for gathering expert opinions on a variety of problems in various domains under market and technology forecasting, especially in situations where expert opinions and views are the only source of information (Blind, Cuhls, Grupp, & Change, 2001). The use of Delphi approaches is also gaining more ground in forest economics to complement quantitative approaches, as pointed out by Hurmekoski, Hetemäki, and Economics (2013).

The Delphi survey is a group communication technique based on an interactive, sequential and multi-step characterization of expert stakeholders, their interests, and intersection of interests. It has the advantage of obtaining opinion from experts, with a guarantee of anonymity, avoiding the potential distortion caused by peer pressure in group situations such as focus group analysis. Iteration, participant and response anonymity, controlled feedback, and group statistical response are recognized as the key characteristics of a Delphi study (J. Landeta, 2006). Some variants of the methodology, such as Policy Delphi or Argument Delphi, highlight the importance of finding reasons for widespread dissent rather than striving for consensus among the Delphi panelists. This appears to be particularly valuable in situations characterized with changing industry strategies and market environments. One of the key benefits of the Delphi method is that it is both easy to use and practical (Hatcher & Colton, 2007), allowing us to bring together geographically dispersed experts at least during two iterative rounds. On the other hand, Delphi requires real
commitment from the expert panel due to the expectations of being involved in multiple information gathering rounds. Also finding the experts may prove difficult, as solid relevant expertise is required from each panelist. Anonymity of the respondents allows argumentation beyond the roles of the panel members, and personal viewpoints can be brought up easily without group pressure (Turnoff & Linstone, 2002). The classic Delphi study has three rounds (Birko, Dove, & Özdemir, 2015):

1. A general questionnaire asking panel members to identify the pressing issues in a given knowledge domain;
2. A second-round questionnaire asking panel members to rate the importance of the list of the issues identified from the first round;
3. A third-round questionnaire, asking panel members to re-evaluate their ratings of each survey item after reviewing the expert panel’s collective stance in the second round in response to the survey questions.

2. Delphi Method as a Forecasting technique

Forecasting studies, however, are complex and, of course, not always accurate at depicting the future. They can only try to anticipate future developments as best as possible (Jiang, Kleer, & Piller, 2017). The core idea of forecasting as a long-range planning tool is to guide decision makers towards certain directions within political, economic, socio-cultural and technological developments and support them in times of high uncertainty. At the same time, forecasting methods should facilitate a discussion among decision makers and topical experts to better understanding the trajectories and possible futures that result from the technology being studied. Since the early 1960s, several technology-forecasting methods have been developed. They are commonly classified into exploratory, normative, and combined methods (Cho & Daim, 2013). Exploratory methods are meant to illustrate the “inevitable future” and project the present state of a technology into the future, assuming a certain progress rate. Methods of this category include trend extrapolation, s-curves, and bibliometric analyses. Normative methods are used to assess the path to reach certain future needs and goals, not only determining the steps to get there, but also assessing the probability of events, and thus work backwards from future to present. This category consists of methods like multi-criteria decision models, morphological analyses, and back casting. A third category, normative/explorative forecasting, is a mix of these two general categories and includes methods such as the Delphi method, nominal group techniques, and trend impact analyses (Forecasting & Change, 2004).

The Delphi method is an interactive multi-stage forecasting method relying on experts to identify technical developments and trends. Its objective is to structure complex group opinions and to develop consensus on future developments among a set of experts participating on the panel (Turnoff & Linstone, 2002). The method was developed by the RAND Corporation to generate scenarios for long-range strategic planning in the 1950–1960 (N. C. Dalkey, 2018) and became a widely accepted approach (Kameoka, Yokoo, Kuwahara, & Change, 2004). Delphi, as a forecasting technique, is described as “reductionist inductive consensual” (Saritas, Oner, & Change, 2004) as it lays particular focus on separate events and tries to reduce the discussed issues to select a best or optimal outcome. The original job of the method was to seek reliable consensus about dedicated propositions among a group of experts (N. Dalkey, 1969). Later, the obligatory need and search for consensus has been dissolved. The Delphi method is now regarded as a research technique facilitating the development of reliable group opinions using expert panels (J. Landeta, 2006). A core benefit of this method is to provide domain experts a place to discuss within a structured setting and to communicate with each other.

The central element of a Delphi study is the evaluation of projections by experts, i.e. statements about the possible future. These projections must be short, unequivocal, and concise in order to make sense of the content and to avoid ambiguity about what the questioner has in mind. Furthermore, the current state of development must be known to the chosen expert panel. The survey itself is considered “a judgmental forecasting procedure” (A. Heiko & Darkow, 2010). Delphi surveys are generally conducted anonymously, in written form, and in a multi-stage process. Saritas et al. (2004) recommend a “systems approach” to the Delphi methodology and scenario planning. This means to take multiple perspectives, not only following the Delphi questionnaire and following its propositions, but also to use additional tools to keep the “big picture” in mind. One source of insights in this regard can be qualitative comments provided by the experts when validating a proposition, and discussions among the experts on these comments.

Furthermore, the conventional Delphi method often consumed much time and failed to produce insights into results (Gnatzy, Warth, von der Gracht, Darkow, & Change, 2011), leading to low response rates and high drop-out rates in spite of extensive moderator effort (Keller, Heiko, & Change, 2014). The “Real-Time Delphi” introduced by Gordon,
Pease, and Change (2006) tries to eliminate most of these drawbacks. Its main idea is to make the judgement process more interactive, engaging, collaborative, and faster at the same time. An internet-based Real-Time Delphi tool developed by Gnatzy et al. (2011) goes another step further. Here, experts receive instant feedback after evaluating a proposition and learn how their peers judged a particular item. This enables them to adjust their initial estimate immediately. Hence, they need less time overall to contribute to an entire study, which results in lower drop-out rates. Moreover, experts can re-access the study at any point to check for new arguments from other participants until the study is closed. The judgement process is therefore more efficient, but also more collaborative and consensus driven supporting a fundamental feature of the Delphi method.

In order to tackle the problem of lack of justification, participants are invited to share arguments for or against a projection. By assigning a random number to each expert, their entries and procedures are kept anonymous, but other participants can follow to see the flow of arguments from one particular expert. The immediate feedback and change of estimates correspond to the several rounds of surveys in a conventional Delphi. Furthermore, direct feedback in combination with statistical and qualitative arguments can improve the accuracy of the results. Recent research shows that such an internet-based Real-Time Delphi works as effectively as conventional Delphi surveys with regard to the quality of validating the propositions (Markmann, Darkow, von der Gracht, & Change, 2013), but in addition provides much more qualitative insights into the development of these validations. These features of the internet-based Real-Time Delphi motivated us to adopt this method as a forecasting method.

3. Delphi Method for Future Studies

In an age of increasing complexity and pace of innovation, futures thinking and foresight are becoming more important and attractive than ever before. Engaging in strategic foresight supports organizations in maintaining sufficient flexibility for future developments and unforeseen circumstances. While governments and public institutions may employ foresight to prepare for the long-term, companies can equip themselves with capabilities to react to weak signals and to quickly change the course of action according to market demand (Rohrbeck, 2010). Consequently, the implementation of foresight practices, such as scenario planning, has increased (Chermack, 2011).

Future studies is less focused on forecasting but may use the results of forecasting to feed its processes. In general, foresight tries not only to quantify important aspects, but also to stimulate the thinking and debating the future by using all available knowledge but also imagination, to activate relevant stakeholders to let them shape their future to their will within the existing constraints that might be imposed by the past. Foresight therefore is often considered as a process rather than a product. This process is primarily based on participative methods and implemented through knowledge sharing and the fostering of creativity. These methods bring together relevant stakeholders and experts to think and debate the future and to create common lead visions or to develop more qualitative scenarios, which sometimes are translated into more quantitative models. Good examples are the "Beyond Current Horizons" exercise (Facer & September, 2009) and the "Future of Learning" exercise (Redeker et al., 2012). To gather information or to visualize the outcomes, the process of foresight may employ different techniques: the construction of scenarios, horizon scanning, vision building, road mapping, back casting, Delphi survey, weak signal search, wild card approach, citizen or expert panels, etc. (Georghiou, 2008).

Linstone and Turoff, define the Delphi concept as the "method of structuring a group communication process that is effective in allowing a group of individuals, as a whole, to address a complex problem" (J. J. T. f. Landeta & change, 2006). Delphi has four important characteristics: anonymity, interaction, controlled feedback, and statistical aggregation of a group of responses (Montes Hincapié et al., 2017). The Delphi Method is an outgrowth of the same process that led to Future Studies. The relationship of the two is that the Delphi method is a tool for providing information into the vision building process that is Future Studies. It is not the only tool available for inserting information into a Future Studies project, others such as forecasting, questionnaires, forums… are also available, but Delphi has a unique place in this process. The Delphi Method is a technique for obtaining information concerning hard to determine or unknown facts or visions of the future from a panel of "experts" using a method of anonymous and controlled discussion or interchange. Hence, it differs from other means of data discovery in that it is not based on trend analysis, random surveys of large populations, or open group discussions (Keller et al., 2014). Each of these although valuable also has well documented flaws. Its purpose is to ferret out plausible answers to questions that defy other readily available means of discovery and then have them discussed and scrutinized by a panel of "experts". Such a panel of "experts" is those highly involved in the area or issue about which the information is desired. These experts are called upon to rationally create and scrutinize answers to difficult questions focused on defined issues which have
unknown answers. The uniqueness of the approach is its method of anonymous and controlled discussion used to build support for one or more possible answers. On a given issue and question each Panel member submits his or her response to a researcher controlling the study. The researcher in turn then shares this information anonymously with all Panel Members. Organizationally, the study is conducted in a series of rounds. After each round results are grouped, tabulated, and written discussion defending given positions by individual panelists summarized. All of this information is then shared with all panel members at the beginning of the next round, at which time panelists are invited to change or maintain their previous answers after reading the summary of comments and reflecting on the level of support for each answer. During each round, panelists are invited to provide whatever arguments and information that can be made to support their position and hence hopefully convince others to join them (McClelland Jr, 2016).

Although some have mistakenly stated that at the end of all rounds consensus emerges, in a true Delphi no such result is necessary, expected, or even desired, instead a stability of positions emerges which may or may not have converged. During, the process along with a summary of panelist provided discussion defending particular answers is a bar chart or histogram listing all answers and the number of panelists supporting each. This is released throughout the study, and it may influence panelists to reconsider their own position along with the summary of discussion. However, unlike an open forum there is no social pressure to join one group or another since the identities of individuals taking positions are confidential. Second, there is no floor to control in focusing the discussion. Since researchers summarize the positions of each faction on an answer down to the seminal argument, quiet voices are equally as important as those coming from verbose dominant personalities are. Further, there is neither shame nor benefit from holding or changing one's position. The purpose is to provide the least biased, rational assessment of arguments and facts, as they exist today in order to create the best understanding of the unknown (A. J. T. f. Heiko & change, 2012).

Rounds end after a specified number or when it is determined that panelists have stabilized in their answers making further rounds fruitless. In a true Delphi, minority positions are treated as equally valid to majority positions. In fact, trigger further follow-up studies to understand why two or more positions are seen as valid answers to a single question. An important concept to keep in mind about a Delphi study is that it taps existing information from the panelists. As a result, a small number of types of responses emerge. First are those from panelists who have a well thought-out answer to a question in advance of the study and are not swayed by others ideas. The second type of panelists are those with some thoughts concerning an issue, but open to whatever new information is provided by the controlled discussion. These panelists are the most likely candidates to change their votes as the process proceeds and they learn more from other members. The third common type would be panelists without knowledge or background about a particular issue and hence would abstain on that issue, but have established opinions on other issues. It should be apparent from a discussion that any panelist could fall into each of these three categories for different issues in a single Delphi study (Weisbord, Weisbord, & Janoff, 2000).

Throughout the years, the Delphi method, along with many other foresight approaches, has faced a lot of criticism (Jiang et al., 2017). Ethics of futures studies, the nature of knowledge about the future, and futures methodology, which together contribute to the quality, validity and credibility of futures studies, have evoked discussions within the existing literature. As regards the Delphi method, the major critique has concerned the method's reliability and judgmental and forecasting accuracy, especially when long-term future is examined (Winkler, Moser, & change, 2016). However, it seems that much of this critique stems from the fact that there is some “greyness” in the technique (Hasson, Keeney, & Change, 2011) indicating that the method is quite flexible and there are no strict general guidelines on how to conduct an overall Delphi process (Wakefield & Watson, 2014). For example, one may question what is the right sample size or sampling technique. The flexibility of the approach in general does not however mean that a carefully planned and executed Delphi study would not be scientifically respectable. Like Jiang et al. (2017), for example, have put it, the key idea of forecasting is to “facilitate a discussion among decision makers and topical experts to better understand the trajectories and possible futures”. Thus, instead of providing accurate descriptions of the future and indisputable facts, foresight approaches inform thinking and help in anticipating future developments especially in situations where objective factual data does not exist (Jiang et al., 2017; Winkler et al., 2016).

Finally, it is important to acknowledge that the Delphi approach has also received criticism and its reputation has been slightly tarnished due to examples from the literature where careless selection of experts, poorly formulated questions, or lack of time to carry out the study have taken place. Therefore, must acknowledge that there would be scope in the future to combine various foresight approaches to build a more multi-faceted analysis of the future.
4. Establishing rigor in Delphi studies

The cornerstone of good research is establishing integrity. However, identifying and gauging methodological rigor for the Delphi technique remains elusive. This is due to a number of reasons such as the ongoing epistemological debate, along with continual modifications. Consequently, the scant studies exploring rigor are mainly experimental, component specific and outdated. This section discusses the literature on establishing rigor in Delphi studies, the methodological trinity of reliability, validity and trustworthiness. In addition, it presents a discussion of the principal forms of establishing rigor, such as the application of rigor using both qualitative and quantitative measurements and corroborating results with relevant evidence in the field for each individual Delphi. Addressing such issues will help enhance the development and utilization of rigor in the future. Traditionally in quantitative research this process is based on the assessment of reliability and validity (Long & Johnson, 2000). In contrast to the quantitative approach, rigor is measured in qualitative research by applying the elements of trustworthiness (Thomas & Magilvy, 2011).

Trustworthiness is composed of credibility, dependability, confirmability and transferability. Dependability refers to the stability of data collected. Credibility relates to the degree to which data can be believed based on the ability of the researcher, whilst confirmability conveys neutrality, which is related to the concept of objectivity in quantitative research. Finally, transferability corresponds to external validity and reports the application of the findings to other settings (Golafshani, 2003). Regardless of what research design is adopted, attention to rigor throughout the process is a vital aspect of research. This is true for many research methods including the Delphi technique. The Delphi technique was originally conceived as a method used to obtain the most reliable consensus of a group of experts by a series of intensive questionnaires interspersed with controlled feedback. However, with increasing usage and modifications of the approach, there are now many different forms in existence, such as the modified Delphi, the policy Delphi, and the real-time Delphi (Okoli & Pawlowski, 2004). It is important to point out that not all Delphi techniques aspire to achieve consensus, for instance, the policy Delphi aims to support decisions by structuring and discussing the diverse views of the ‘preferred future’ (Novakowski, Wellar, & A, 2008).

In the context of the reliability of the Delphi method, a number of authors claim that the Delphi approach enhances reliability. This belief is based on two principles, firstly, the claim that the interactive nature of the approach, combined with the avoidance of group bias and the occurrence of group think scenarios, enhances the reliability of the results. Secondly, as the panel size increases, the reliability of the respondent group also grows, based on the belief that a larger group will reflect the opinion of the population, providing a smaller confidence interval. Such claims have been widely questioned (Yousuf & evaluation, 2007) as the larger the sample the more variation can occur, diminishing the degree of accuracy and level of generalizability. Such scenarios can lead to a false consensus being obtained, as it forces participants to reach a consensus without any opportunity to debate the issues (Morgan, Lam-McCulloch, Herold-McIlroy, & Tarshis, 2007), leading Loo (2002) to claim that the use of an open-first round makes the assessment of reliability problematic.

In the context of the reliability of the Delphi method, Numerous writers have claimed that the Delphi technique provides evidence of content and face validity (Huang, Lin, & Lin, 2008). This belief is based on three key assumptions. Firstly, the results stem from group opinion, which is assumed more valid than a decision made by a single person. Secondly, the process is based on expert opinion from the ‘real world’ providing confirmative judgements on the subject. Finally, the process of a classical Delphi, combining an open first qualitative round allows experts to generate scale items. In addition, the continual succession of rounds allows the opportunity to review and judge the appropriateness of the scale. In reality however, a Delphi sample may have certain features that influence results, validity is influenced by the number of experts in a sample and the level of expertise and agreement that the experts possess. Moreover, a traditional first round may create unambiguous, broad statements, which could lead to bias from the outset. Therefore in order to verify the content and face validity the use of a modified (close ended) Delphi, has been recommended (Hsu & Sandford, 2007).

5. Conclusion

Delphi practitioners need to address such issues and be explicit about how and why they choose such criteria. It is recommended that measures of rigor for both qualitative and quantitative be applied to each Delphi study as well as its findings to be confirmed and verified. Addressing such issues will help enhance the development and utilization of the Delphi in the future. In addition, further researches are needed to survey the efficiency and effectiveness of combined methods in order to compare outputs in this paper, concerning foresight studies.
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