Technological Forecasting & Social Change 78 (2011) 1681–1694

Contents lists available at ScienceDirect

Technological Forecasting & Social Change

Validating an innovative real-time Delphi approach - A methodological comparison between real-time and conventional Delphi studies

Tobias Gnatzy *, Johannes Warth, Heiko von der Gracht, Inga-Lena Darkow

Center for Futures Studies and Knowledge Management, EBS Business School, Soehnleinstrasse 8A, 65201 Wiesbaden, Germany

ARTICLE INFO

Article history:
Received 29 October 2010
Received in revised form 28 March 2011
Accepted 6 April 2011
Available online 28 May 2011

Keywords:
Real-time Delphi
Conventional Delphi
Foresight
Methodological comparison

ABSTRACT

A novel and innovative real-time Delphi technique is introduced in order to address previously identified weaknesses of the conventional Delphi method, such as complicated facilitator tasks, lack of real-time presentation of results, and difficulties in tracking progress over time. We demonstrate how the real-time (computer-based) method increases the efficiency of the process, accommodates expert availability, and reduces drop-out-rates. Modifications in the Delphi procedure (e.g. change of iteration principle) not only increase efficiency but also change the nature and process of the survey technique itself. By identifying and analysing three individual effects (initial condition effect, feedback effect, and iteration effect) we examine whether the modifications in the survey process cause deviations to the survey results. Empirical data obtained from both conventional as well as real-time Delphi studies is analysed based on multiple statistical analyses. The research findings indicate that significant differences between the two Delphi survey formats do not exist and final survey results are not affected by changes in the survey procedure.

1. Introduction

Since its first application in the 1950s by the US RAND Corporation, Delphi has become a widely accepted and frequently used research method, especially for futures oriented research. The conventional Delphi can be defined as a method that aims at a consensus on a particular topic among a group of experts [1], while the procedure (paper-and-pencil version) follows an anonymous, multistage communication process based on several survey rounds. Previous publications prove that the technique is an established method for foresight activities and that Delphi outperforms other group formats such as statistical groups or standard interacting groups in terms of effectiveness [2,3]. Whilst the method itself has become more prevalent and mature, a number of researchers have focused on improving the procedure and tasks of Delphi [2,4–13] due to critique on the method in the past.

Related to the process and task characteristics of a conventional Delphi survey, Tapio [14] and Gordon and Pease [5] identify several major areas of improvement. They address the challenge of increasing efficiency in order to shorten the time to perform a Delphi survey. Moreover, the availability of experts and the drop-out-rate are identified as major methodological challenges: the repetitive and multiple feedback character of Delphi studies demands considerable time until such studies are completed, which can increase the likelihood of drop-outs [6,15].

In line with other researchers [e.g. 6,16,17], Gordon and Pease [5] therefore attempted to increase the efficiency of the Delphi survey procedure. By omitting sequential rounds and thereby shortening the time frame needed to perform such studies, Gordon and Pease improved the traditional Delphi survey process by calculating experts' responses online in "real-time". Furthermore, they addressed the issues of expert participation and simplifying the process by providing experts the opportunity to participate in the survey via the Internet. Although Gordon and Pease describe their innovative survey method and its benefits as successful, they

* Corresponding author. Tel.: +49 611 7102 2127; fax: +49 611 7102 1990.
E-mail address: tobias.gnatzy@ebs.edu (T. Gnatzy).

0040-1625/$ – see front matter © 2011 Elsevier Inc. All rights reserved.
doi:10.1016/j.techfore.2011.04.006

also concluded that their online, real-time survey method exhibits some weaknesses such as the ease-of-use for the facilitator of the Delphi survey, the real-time presentation of results, and the tracking of progress over time, which all require further research and development. Moreover, modifications to the Delphi technique (e.g. round-less, real-time approach) not only increase efficiency in terms of procedure and questionnaire handling, they also change the nature and process of the survey technique itself. Delphi's principle of iteration is affected by immediate provision of feedback and by experts' ability to reassess and adjust their responses as often as they want to. Consequently, the results of a real-time Delphi study could deviate from those of a conventional Delphi study. However, these possible effects have not been studied yet.

This paper contributes to research on Delphi techniques in two ways. First, we introduce a novel real-time Delphi technique that overcomes the shortfalls identified by Gordon and Pease. This real-time Delphi method increases efficiency more than other online-based Delphi surveys and is more convenient for participants. Even though the use of the Internet may help to reduce the time required to conduct a Delphi survey in general, the conventional idea of having several survey rounds is still present. Consequently, experts have to be available and willing to participate in the conventional survey process for at least two survey rounds (assuming that the survey is based on only two survey rounds) and thus dedicate considerable resources into the survey process. If experts do not participate in a later survey round, the facilitator of the Delphi survey would register drop-out rates.

In order to improve and simplify the process of conducting a Delphi study, we developed an internet-based, real-time Delphi survey format which operates without the necessity of having sequential rounds. Once an expert provides his/her initial assessment (which would correspond to survey round number 1 in a conventional Delphi study), he/she receives immediate feedback and is able to reassess the initial estimate (which would correspond to any later survey round in a conventional Delphi study). Consequently, experts need to dedicate fewer resources for participating in the Delphi survey process.

In addition, we specifically illustrate how an internet-based, real-time Delphi survey tool can be equipped with innovative features such as *easy-to-use facilitator portal*, *consensus portal*, and *graphical real-time feedback* to make it easier for experts to participate and for survey moderators to facilitate.

Second, we investigate whether modifying the survey procedure of a real-time Delphi study causes differences in study results. We identify three individual effects that may impact the results of the Delphi study: *initial condition effect, feedback effect,* and *iteration effect*.

In the preparation phase of conducting real-time Delphi studies, it is necessary to provide a set of initial conditions so that even early respondents can receive feedback [5]. We examine whether these initial conditions adversely affect experts' behaviour in the survey process. While experts participating in conventional Delphi surveys do not receive feedback until a certain amount of peers have finished the survey, real-time Delphi participants receive immediate feedback after their responses. Therefore, we compare the effect of feedback provided real-time versus the effect of feedback provided in sequential survey rounds on responses. Furthermore, we analyse whether the convergence processes (i.e. how consensus is achieved) between conventional, round-based Delphi surveys differ (significantly) from real-time Delphi formats. We conduct multiple statistical analyses based on data obtained from a Delphi study that utilizes our new real time Delphi technique and data from a conventional Delphi study to analyse the impact of the 'initial condition effect', 'feedback effect', and 'iteration effect'.

The remainder of the paper is organized as follows: Section 2 outlines the process and task characteristics of the newly developed real-time Delphi survey tool. By referring to two concrete Delphi studies, Section 3 compares the differences of the real-time Delphi technique with the conventional Delphi technique and the potential consequences on final results. The final section summarizes the methodological contribution of the paper and addresses limitations as well as future research areas.

2. Elements of the real-time Delphi survey tool

In order to address the major shortcomings of Delphi studies, several approaches have been followed in the past to increase the efficiency of the process. Researchers provided downloadable questionnaires from the Internet or asked participants to assess questionnaires directly online [11,12,18]. In an interesting study regarding future information technologies in the health care sector, Cuhls et al. for instance performed a two-round based Delphi survey by exclusively using an online platform [12]. However, to the best of our knowledge, no immediate feedback was provided in these studies. Rather, feedback was compiled in an offline modus, leading to a time delay between initial assessment and the provision of feedback. In their attempt to address this time delay, Gordon and Pease developed a "real-time Delphi" platform that provides immediate feedback [5]. Consequently, immediate feedback is the main difference between the real-time Delphi format and general online future surveys where experts can judge as often as they wish.

In line with Gordon and Pease [5] we approach the major shortcomings of Delphi by developing an extended real-time Delphi survey tool, which we applied for futures research. We developed additional functions to further improve the Delphi survey process and task characteristics. An online survey tool allows experts to participate in the study regardless of their physical location. Our real-time Delphi survey tool was additionally equipped with innovative features such as *easy-to-use facilitator portal*, *consensus portal*, and *graphical real-time feedback* for better process efficiency and convenience. In addition, our real-time Delphi survey tool was developed to be easily adaptable for further studies. Furthermore, a tutorial, which is accessible during the entire survey process, explains to experts how to use the tool and answers questions which might arise during the survey process in order to ensure adequate validity and reliability. These innovative features will be dealt with later in the paper.

According to Rowe et al. [9], four main characteristics of the Delphi method can be identified: (1) anonymity in the process, (2) controlled feedback, (3) statistical aggregation of group response, and (4) iteration. In the following discussion, the elements of our real-time Delphi survey tool will be illustrated with respect to these characteristics.