
Transportation & Logistics 2030

Delphi Survey Tutorial

*Methodology
background
for our clients
and partners*

December 2010



Welcome

Welcome to our exclusive Real-Time-Delphi survey, a key element in the global PwC thought leadership project “Transportation & Logistics 2030”.

This project will primarily address future scenarios, based on a mix of desk research, qualitative and quantitative research. The quantitative portion of the research will include the results of a survey conducted using the Delphi method, one of the preferred methodologies for future studies. The questionnaire itself will be divided into several sections, each covering projections applicable to a particular scenario.

Participating in the Real-Time-Delphi survey gives you the opportunity to shape the publications’ content and to share your visions of the future with an international, renowned expert panel. In light of the results, we will discuss what developments the T&L industry may be undergoing over the next years and what action leaders in the T&L industry should take.

This tutorial provides you with all the information you need to participate in the Delphi survey, as well as background on the Delphi technique’s history. We hope that you enjoy this opportunity to engage in thinking and debate around the future and are curious to learn about your visions of 2030.

The Real-Time-Delphi survey is conducted using a web-based assessment (*Real-Time-Delphi Survey*) of theses on the future of logistics to 2030. You will be asked to anonymously evaluate the probability of occurrence, impact, and desirability of each thesis. A statistical group opinion of all participants is directly calculated and provided thereafter, together with the stated rationales of other participants for their responses. Based on this data, you will have the opportunity to re-assess, and potentially revise, your initial response. This process serves to achieve an expert consensus. The final results of this Real-Time-Delphi survey will form the framework for a more extensive and detailed discussion of the specific future scenarios envisioned. We will publish the results in a broadly-released thought leadership publication. As a survey respondent, you will naturally also receive a copy of the final output.

The average time to complete the on-line questionnaire ranges from 20-45 minutes, depending on how much time you take to enter your numerical estimations. You can interrupt your session at any time – simply use the “save & return later” button at the bottom of the screen. Via a personalised link, you can return to the portal at any time until its closure and monitor how group opinion may have changed as the number of participants increased. Feel free to revise your answer as often as you like.

We recommend that you consult this tutorial prior to receiving a link to the survey, as it provides relevant background information on the survey technique.

If there are questions that remain open after the tutorial, please do not hesitate to **contact us**.

The Delphi Technique – Fundamentals

A classic Delphi survey comprises several rounds. Once the future assumptions, or projections, have been developed, the first round of the survey involves a group of previously selected experts. They are individually and anonymously confronted with questions which require quantitative appraisals. In addition to the appraisals, each expert can also provide comments to justify his or her opinion. Before the next round, all the participants can view the cumulated group appraisal and the comments made. The participants then have the opportunity to modify their appraisals. Through this Delphi process, the panel of experts come close to reaching a consensus.

A real-time and web-based Delphi tool which refines this process will be used in this study. The Real-Time Delphi eliminates the formal rounds used in the classic Delphi process. Instead, participants are provided with information on the current status of the survey once they have finished answering each question. Participants can revise their evaluation of each projection as many times as desired, both by revising the prediction at the end of the initial session, or by logging in again to view how the overall consensus has developed.

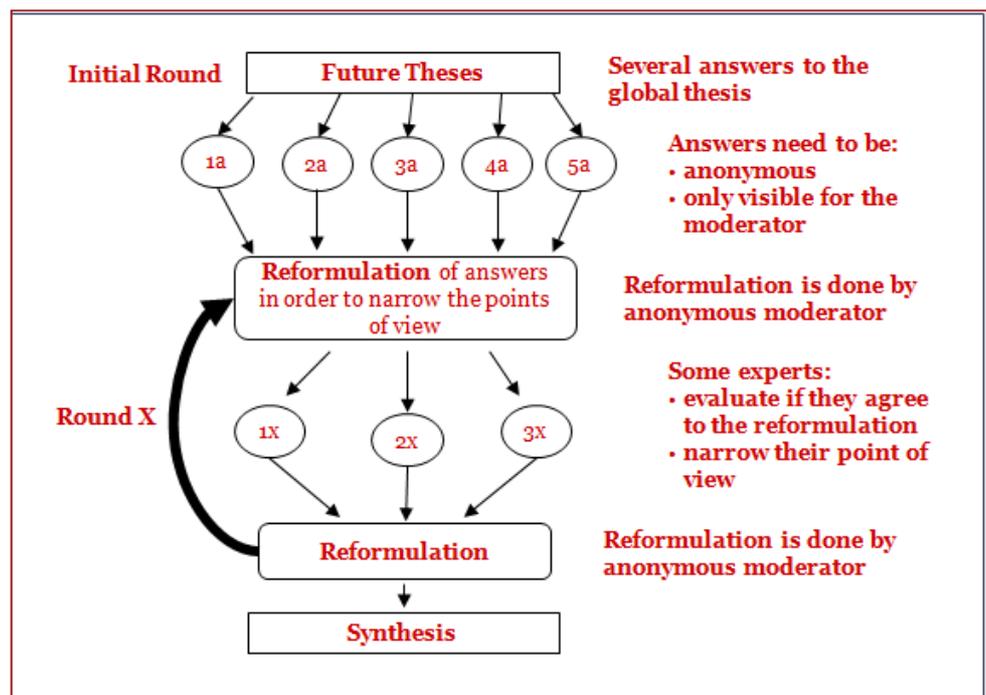


Figure 1 Classic Delphi Survey Process

The Delphi Technique - Procedure

The Real-Time-Delphi survey is an innovative and quick-response platform for participants to evaluate their expectations of the future. The Delphi software is designed to be self-explanatory. Nevertheless, participants will be able to access a software tutorial at any point in the process, which explains the background to and the procedures used in the Real-Time-Delphi. The participants will be asked to evaluate approximately 20 projections online. Immediately after answering a question, a real-time calculation provides the participants with insight into the statistical group opinion and comments collected

The first round will run through all assumptions, i.e. all first round screens and all revision screens with group statistics. Each time the participant logs in subsequently, and is taken to the current consensus portal, it is considered to be a new round.

The statistical group opinion will then be provided for each projection in the form of a boxplot (see Fig. 2). A boxplot (also known as a “box-and-whisker plot”) can be described as a diagram showing a row of univariate numerical data (e.g. from 0 to 100%) as well as several characteristics of the series of data (e.g. median, distribution, outliers).

The median is indicated by a black line in the boxplot. A gray shaded area showed the second and third quartile – also called “interquartile range”, which is known as a measure of dispersion. The central innovative aspect of the boxplot is the graphical and differentiated illustration of an outlier position. Divergence from the group is indicated using different colors:



Figure 2 Sample boxplot illustrating group responses for a projection

An “outlier labeling rule” also helped with classifying observations as “out” or “far out” of the group opinion.

In addition to the statistical group opinion, the rationales already submitted by the experts for each projection can also be viewed. Once all projections have been answered, the session ends automatically.

When next logging in, each participant will be immediately taken to a consensus portal. The consensus portal is a form of control panel that allows a respondent to review as many projections as desired. The color of the buttons indicates to what extent a respondent’s answer converges or diverges with the group opinion.

The iterative nature of the process enhances the validity and reliability of the results and ensures that knowledge and expertise is shared within the group, without the bias that a face-to-face meeting might bring. The innovative concept of the Real-Time-Delphi is thus an excellent tool for use in forecasting possible futures.

Scientific consideration of Delphi

Definition of the Delphi technique

Delphi is an efficient group dynamic process which aims at achieving consensus among experts. This is done in form of an anonymous, written, multi-stage survey process, where feedback of group opinion is provided after each round.

Rationales of the Delphi technique

1. **Anonymity:** In Delphi studies the participants usually do not know each other. *Anonymity* is guaranteed since the process is coordinated by a moderator. This procedure assures that socio-psychological pressures on panellists are eliminated.
2. **Iteration:** The procedure is executed in a series of rounds. The judgements of the respondents are summarised by the facilitator and fed back as basic information for the following round. In the case of this Real-Time Delphi, a statistical analysis is conducted automatically once responses have been entered.
3. **Controlled feedback:** After each Delphi round, the survey data is statistically analysed and fed back in aggregated form.
4. **Statistical group response:** The statistical group response can be presented either numerically or graphically and usually comprises measures of central tendency, dispersion, and frequency distributions. After reviewing the group statistics, each participant can decide on whether to change or to stick to his previous answer.
5. **Group judgement:** In judgemental forecasting a group is superior over individual performance. Underlying the Delphi process is the expectation that views of the group (one person +1) will be more accurate than those of one person alone and that the potential sum of useful information aggregated by the group will be greater than that of any particular individual.
6. **Expertise:** Experts, particularly when they agree, are considered more likely than non-experts to be correct about questions in their field.
7. **Convergence:** The level of agreement among the experts increases with proceeding rounds. This is induced by the feedback of the group response. The convergence is usually measured by a decrease in the range of responses.

History of Delphi: From oracles to Real-Time

To know what the future will bring has always been a desire of humankind. Throughout history, people have consulted chosen individuals who were said to be able to anticipate the future. Especially in ancient times, prophets and priests who were able to accurately predict the future wielded great influence. For over a thousand years oracles held a firm place in the life of Romans and Greeks. People consulted oracles on a wide range of issues, including fortune, success, marriage affairs, professional advancement, and judicial disputes. Oracular sites were spread all over Greece with the two most important located at Delphi, associated with Apollo, and at Dodona, associated with Zeus.

The Greek word Delphoi means “hollow” or “womb”. Historians interpret it as a reference to the archaic veneration of Gaia, the Grandmother Earth. Legend holds that Apollo, the son of Zeus and Leto, chose Delphi (170 kilometres northwest of Athens on the slopes of Mount Parnassus) above all other places for his most truthful oracle. The oracle lasted through many centuries, which underlines the priests’ professionalism in formulating the prophecies and in gathering the relevant information beforehand. The rise of Christianity marked the end of the oracle’s era.

After years of being used solely for military purposes, the Delphi technique was presented to the public in 1964. The first civil application of the research technique, titled “Report on a Long-Range Forecasting Study”, was conducted by T. J. Gordon and O. Helmer in the year 1964. The report was based on various Delphi questionnaires and asked 150 persons to evaluate future developments (50 years ahead) in the following six broad areas: scientific breakthroughs, population control, automation, space progress, war prevention, and weapon systems. After this study the Delphi technique became widely used among companies and research institutes all over the world in order to obtain a reliable consensus of opinion of an expert group. The Delphi technique is believed to overcome general group inefficiencies, such as bandwagon, underdog, and halo effects. Today, the Delphi technique is one of the most commonly applied methods of futures research. Between the years 2000 and 2004, more than 1,300 scientific publications and more than 270 doctoral theses dealt with the Delphi technique.

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