



## Identification of future fields of standardisation: An explorative application of the Delphi methodology

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### ABSTRACT

This paper investigates the application of the Delphi methodology for the identification of future fields of standardisation complemented by a methodological extension by using various science and technology indicators. By the term standardisation, we broadly mean the process of developing and implementing technical standards within a standardisation body. Underlining the explorative nature of this paper, we describe the process of identifying future fields of standardisation.

To provide a systematic forecasting view on complex science and technology fields, a combination of quantitative indicator-based analyses and qualitative in-depth Delphi surveys is chosen. Firstly, statistical analyses of suitable indicators are used to identify dynamic developments in such fields. Secondly, to identify detailed challenges for future standardisation, qualitative Delphi surveys are conducted. To collect and evaluate relevant issues the respective expert communities were included. They were identified by using information derived from the science and technology databases used.

The paper concludes with the assessment of the chosen approach and give practical insights for its feasibility based on a review of the existing literature on the Delphi methodology. In addition, an outlook for further improvements and other possible fields of application is given.

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## 1. Introduction

Foresight activities are considered to be multi-stage processes. They are always marked by a variety of objectives. Nevertheless, there is one primary purpose for the implementation of foresight in general: The identification of future areas of science and technology in which an organisation, e.g. a country, a company or a research organisation, can achieve an international forerunner position. As Martin [1] puts it: The ultimate objective of foresight is to ensure that areas of science and technology that are likely to yield future socio-economic benefits are identified promptly. The identification of such future fields can only be achieved by examining the science and technology base, the institutional constitution and the economic strength of a country or of an organisation. This should be put into the context of general technological developments. In other words, a country's or a company's ability to produce and commercialise a flow of new technologies over a longer period of time [2] is essential for their economic development. The potential to innovate, as well as other important determinants of the innovation process are summarised in the national innovation system (see for example [3]). It also includes the capabilities or the economic competence of the actors of the system to generate, diffuse and commercialise technologies [4]. Here standardisation can enhance these capabilities.

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By the term standardisation, we broadly mean the process of developing and implementing technical standards. By including all interested stakeholders, the standardisation process aims at avoiding technical application obstacles by unifying and standardising. More precisely, a published de-jure standard specifies fixed rules, guidelines or characteristics for tasks and their results. It is a universally accepted and generally applicable rule. Standards are created by a consensual process and are approved by a recognized institution, such as a national standard body (NSB).<sup>2</sup> However, they have the form of recommendations, unless their compliance is obligatory under national or international laws or regulations. By promoting the diffusion of technological knowledge by creating and using de-jure standards and technical guidelines, standards are considered to be necessary for the economic development of a technology.

Despite its economic importance, there is a lack of references on scientific findings in the day-to-day business of standardisation committees. This is the result of frictions between current scientific research and the roadmap of future standardisation processes. This problem in mind, we developed a supplementary indicator-Delphi approach for conducting systematic foresight studies for the identification of future fields of standardisation. This approach is also applicable to other foresight application areas.

The approach supplements the classical Delphi approach with statistical analyses of indicators, which provides a sound overview of complex science and technology fields. The indicator approach is used to identify future dynamic fields in science and technology as well as possible panel experts for subsequent Delphi surveys. Based on the results of this first analysis, in-depth online Delphi surveys with consecutive rounds will be carried out, both qualitative and quantitative. Using the implicit knowledge of participants, the methodology reveals conflicting as well as consensus areas [5] for these fields.

This article focuses on three different objectives. (1) Investigates a possible extension of the Delphi technique using a combination of quantitative indicator-based analyses and qualitative in-depth Delphi surveys. To introduce the method, the set of indicators and some possibilities for the statistical and bibliometric analysis are specified. In addition, specific methodological characteristics are elaborated. (2) By applying this approach to standardisation foresight, a novel practical application area for the Delphi methodology is introduced. This paper especially focus on the exploratory study of the application area. In particular, the characteristics of the stakeholders of standardisation processes are described. (3) Finally, the applicability of the method will be evaluated. For this purpose, it will be discussed whether the indicator approach is a useful addition, especially for the identification of key experts for Delphi surveys and whether it can be used in other application areas.

The remainder of this article is structured as follows. Section 2 gives practical preliminary considerations for standardisation foresight. Section 3 provides theoretical background on science and technology indicators, the Delphi technique, and the role of standardisation in the R&D process. In Section 4 will give a more general description of the method. It is followed by a comparative analysis of conducted case studies. In addition, modifications made to the approach, addressing some practical issues will be described. The paper concludes with some methodical considerations as well as practical insights for its feasibility. Recommendations and limitations of the approach, as well as its use in other application areas are discussed.

## 2. Practical preliminary considerations for standardisation foresight

To choose an appropriate foresight approach for identifying topics of standardisation, it is necessary to consider the general characteristics of the standardisation processes. As in many coordination processes, adequate stakeholder participation is essential to standardisation. Nevertheless some standardisation processes are characterised by an unbalanced stakeholder representation [6]. Even though the relevance of standards in basic research is notably high, research institutions are underrepresented in many standardisation committees. Negative impacts on quality and application of resulting standards are most likely [6].

Standardisation processes are multi-stage coordination processes resulting in a consensual standard, established in collaboration with the standardisation bodies. Many heterogeneous stakeholders are involved, who act on their individual interests. Many of these characteristics hold true for Delphi approaches as well, or can be reproduced by them. In addition, Delphi surveys, with their consecutive rounds and intermediate feedback resemble a standardisation coordination processes, but lack the interactive parts of committee group discussions. Furthermore, the primary purpose of the Delphi methodology is to obtain the most reliable consensus of opinion of a group of experts [7,8]. Table 1 summarises these similarities. Considering all these points, the Delphi technique seems to be an adequate method for determining future standardisation issues.

In both processes the selection of panellists or stakeholders is a matter of high importance and presents a difficult task. For Delphi approaches, Härder [9] makes the recommendation that the selection process should be oriented towards the function and objectives of the survey.

The objective targets of standardisation foresight are oriented on two typologies (see [1,9]). The typology by Martin [1] classifies foresight methods along several key features, characteristics and intermediate functions. It distinguishes between: (a) direction-setting, i.e. establishing broad guidelines for policy or regulation; (b) determining priorities; (c) anticipatory intelligence, i.e. providing background information and an early warning of recent developments; (d) consensus generation; (e) advocacy for a new research initiative or defending an existing programme; and (f) communication and education within the research community. The typology by Härder [9] outlines main objectives of Delphi surveys: (a) idea generation, which, in contrast to the classical Delphi approach, evaluates qualitative responses; (b) exact prediction of an uncertain fact; (c) evaluation of the opinion of a group of experts about a diffuse fact; and (d) reaching a consensus among the participants.

<sup>2</sup> See also the definition of the term de-jure standard in EN 45020.

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