

Development and Perspectives of Foresight in Germany

by Kerstin Cuhls, Fraunhofer Institute for Systems and Innovation Research (ISI)

It is possible to ascertain a development of national foresight activities in Germany over roughly ten years. The most significant milestones are described in this article which also contains an overview of the principles underlying foresight in Germany and internationally. Based on a definition of what is understood by "foresight", the developments which are presently emerging in the performance of foresight activities are described.

1 Development of Foresight in Germany

During the 1980s, German science and technology policy was not very active in foresight. It was predominantly a decade of strong support for basic research, mainly in large facilities, following the recommendations of scientific advisory committees. The German Federal Ministry of Research and Technology (BMFT, re-named BMBF since 1994) played a major role in S&T policy by, firstly, organising and funding research in "high technology" sectors subject to state procurement such as nuclear energy or aerospace; and secondly, supporting industrial R&D through a variety of mechanisms, including direct and indirect subsidies to firms; and thirdly, financing special initiatives by maintaining a scientific infrastructure (Meyer-Krahmer 1990).

Increasing technological change and the globalisation of markets, as well as the special situation after the re-unification of Germany with its severe budget restraints made the responsible persons at the BMFT change their minds (Martin 1995). There was a search for longer-term perspectives and strategies to make better use of the limited resources.

For political reasons, care was required to avoid equating foresight with the kind of planning which had existed in the command-and-control economies. Certainly, as Coates (1985, p. 30) noted, foresight is defined as "a process by which one comes to a fuller understanding of the forces shaping the long-term future which

should be taken into account in policy formulation, planning and decision-making ... Foresight is, therefore, closely tied to planning. It is not planning – merely a step in planning." In addition to the fact that a foresight process must be systematic and comprehensive (Martin 1995), able to accommodate a wide range of information, must be public and avoid prediction, German ministries had to make allowances for suspicion in public opinion. Thus, the term "foresight" is used in the sense of "outlook". This is not the same connotation as a "prediction" which would be closer to "forecast" (Cuhls 2003). Foresight takes into account that there is not a single future. Depending on action or inaction at present, many futures are possible, but only one of them will happen.

Some long-term prospective studies were commissioned in 1991 to indicate the most promising developments in science and technology.

The BMFT decided not to use a single approach, but a broader range of studies to have a basis to make choices and to combine data. Two larger foresight activities were started first with two Delphi processes following. The four approaches which have been applied in Germany all fulfil the following functions, which are defined as major purposes of foresight by Irvine and Martin (1989, p. 30 f.): 1. Direction-setting, 2. Determining priorities, 3. Anticipatory intelligence, 4. Consensus-generation¹, 5. Advocacy², and 6. Communication and education. Public and private institutions can make use of these foresight studies.

The first study was **Technology at the Beginning of the 21st Century**, a BMFT-sponsored project which started in 1991 with a study of the international literature concerning technology foresight. The main motive behind this study was to complement economic growth criteria by the idea of growth using intelligent new technologies. Secondly, learning mostly from US sources, a stricter and more transparent methodology was to be tested. The approach also aimed at a mobilisation of the in-house expertise of German research administrators for foresight purposes. Representatives from the German "Projekträger" (programme operating agencies) set up a task group and worked face to face on an assessment of critical technologies for the Federal Republic of Ger

many. The Fraunhofer Institute for Systems and Innovation Research (ISI), which assumed overall responsibility for this task, was asked to devise a comparatively new methodology based on *relevance trees*. The time horizon of the study was approximately the year 2000.

The study “Technology at the Beginning of the 21st Century” concentrated on

- the selection of critical technologies
- the criteria to assess these technologies (relevance trees)
- the inter-relation between the technologies and
- the time scale (see Grupp 1993 or 1994 for further details).

A second study started at the same time. The 1993 Long-term Foresight Survey on Science and Technology (**Delphi '93**, BMFT 1993) was a test of the applicability and acceptability of the Delphi method in Germany. It was also a test to see if information about the longer term future can be gained and spread. Another purpose was to learn about visions of future technology in Japan.

The Delphi method consists of a survey conducted in two or more rounds and provides the participants in the second round with the results of the first so that they can alter their original assessments if they wish to – or stick to their previous opinion. Nobody “loses face”, because the survey is done anonymously using a questionnaire. It is commonly assumed that the method makes better use of group interaction (Bardecki 1984; Rowe et al. 1991; Häder, Häder 1995) in which the questionnaire is the medium of interaction (Martino 1983). The Delphi method is especially useful for long-range foresight (20-30 years), as expert opinions are the only source of information available.

Delphi '93 made use of previous experiences in Japan where a large study has been conducted every five years since 1971 under the auspices of the Science and Technology Agency (STA, now Ministry of Education, Sports, Culture, Science and Technology, MEXT) (Cuhls 1998 and 2001). To achieve learning effects, ISI collaborated with the Japanese National Institute of Science and Technology Policy (NISTEP), an institute of the STA. Most of the 1,150 topics prepared for the fifth Japanese survey were

translated into German (for details see Cuhls, Kuwahara 1994).

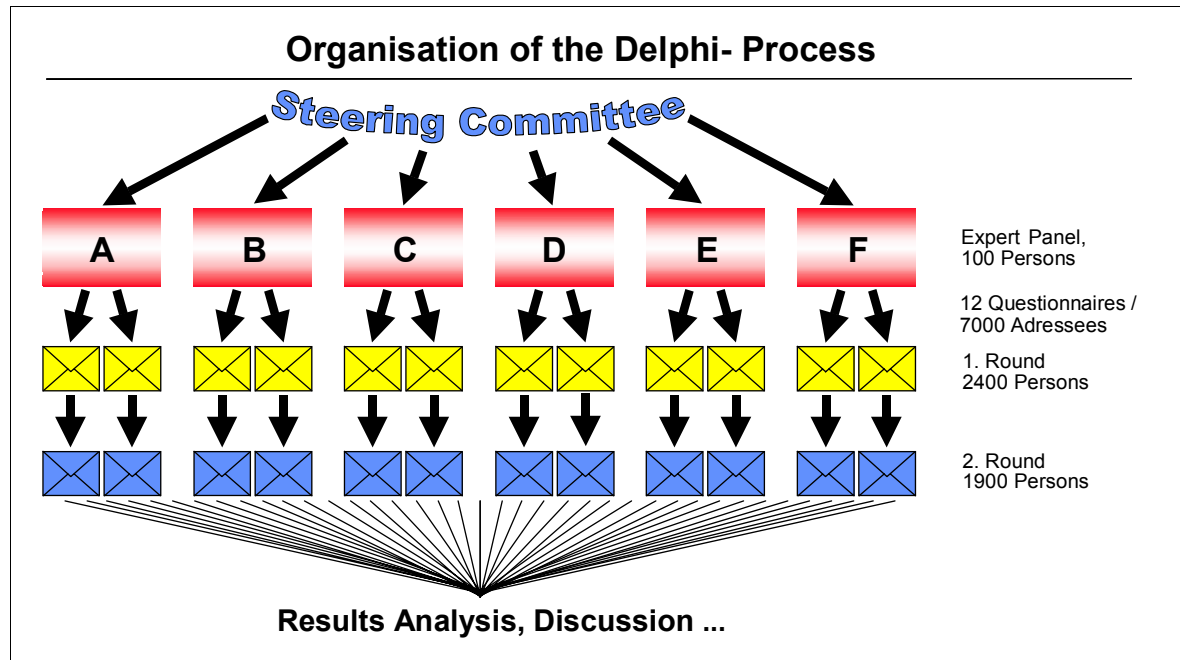
The objective of this foresight investigation was to assess the degree of *importance* assigned to the topics by the experts, the *time of realisation* between 1995 and 2020, major *constraints on realisation* or reasons for non-realisation, the *precision of time determination* and the *necessity to co-operate internationally* in pursuing technology progress. Also the degree of *expertise* of the participants was self-estimated.

As expected, not only did the analytical part of the survey provide important information for German S&T policy, but there was also an impact on the participants themselves. By answering the questions and checking their opinion with the anonymous assessments of the other experts, a learning effect occurred among the participants in the survey who were able to make free use of the information in their laboratories. And in addition, they learned about the major projects in science and technology in Japan. The data showed that a consensus was achieved in some cases, while in others, the division of opinions remained. The results did not lead directly to priority setting: However, many companies and BMFT itself used the process for reference.

The third process was the **1996 Survey on the Development of Science and Technology (Mini Delphi)**, which was an exploratory investigation to develop the Delphi method further in response to criticism of the first German Delphi survey and to gain more detailed data about some of the internationally problematic areas. The “Mini Delphi” is more oriented towards technical solutions for current or emerging problem fields which were identified as the most important in the previous Delphi survey, e.g., cancer research, brain research, climate change, recycling but also micro systems and nano technology. Expert committees in Japan and Germany selected the major topics jointly (at a conference in Berlin 1994, and as “virtual groups”). Between the first and the second round, some of the topics were intentionally reformulated more precisely because of expert suggestions, and some new topics from the broader survey sample of experts were introduced.

The whole procedure of the survey was conducted in parallel both in Japan and in Germany. The co-operation partners were again the

Figure 1: Organisation of Delphi '98



Fraunhofer ISI and NISTEP. In order to match about 100 answers per topic, 2,300 experts were contacted in the first round in Germany. Not only were the self-assessed *expertise* and the *time of realisation* asked for, but also *alternative solutions*. The importance category was split into importance for *science and technology*, for the *economy*, the *environment*, *developing countries* and *society*. In the last category, the framework conditions had to be evaluated. All results from Japan and Germany are available in a free booklet from the BMBF (BMBF 1996; original Cuhls, Breiner, Grupp 1995).

The latest long-term study on science and technology started in 1996 and was called **Delphi '98**. It was conceived as an update of the existing data. In response to a demand from German industry, the national situation was reflected more than in Delphi '93. Again, information about the future of science and technology in Germany was to be collected and shared with all interested parties. BMBF intended to make more strategic use of the data and work out priorities for its research policy. For the sake of international comparisons, topics from the sixth Japanese Delphi which took place in parallel, were also adopted. The major objective of foresight was broadened very much to include communication and networking effects, bringing together different

stakeholders in the innovation system (Cuhls 2000; Kuhlmann et al. 1999)

As a first step in Delphi '98, BMBF set up a steering committee of 10 prominent persons from business and academia, including a science journalist. The preparation of the study (items etc.) took place in specific committees with more than 100 specialists from industry, university and other research institutions. The committees met for a kick-off meeting and then started to co-operate. Each expert committee was responsible for two of the 12 fields (which meant two questionnaires) in order to facilitate the interdisciplinary exchange of information and to formulate problem-oriented solutions involving more than one sector, discipline or field of interest (cf. Fig. 1 next page). The 7,000 persons contacted were "experts" in a broader sense and never for a whole questionnaire but for individual topics. Included were "experts" from business, academia and research institutions, associations, the media and others.

The whole process was co-ordinated by the Fraunhofer ISI in Karlsruhe. The questionnaire incorporated the successfully tested methodological improvements regarding a differentiation of "importance". It also asked for the *time frame* of the innovations, the *leading country* in the field, the *measures* to be taken at the national level and possible *follow-up problems*

(e.g. for the environment, security or social, cultural and societal problems).

Another novel feature of Delphi '98 were 19 so-called megatrends, meaning the overall directions and perspectives outside of science and technology. Assessments on these provided indications of pictures of the future in the minds of experts when looking at technical or scientific projects. The results of the Delphi '98 were published at the beginning of 1998 (Cuhls, Blind, Grupp 1998, 2002). Activities to make use of the results and their communication effect were planned.

In order to counter the criticism that only "experts" were involved in activities, and to open up the German national foresight processes for more varied participants, BMBF decided to organise a new foresight process called **Futur**. This process was the first version of the currently running Futur process. It put special emphasis on the use of the Internet as a platform to discuss the different topics. The kick-off meeting took place at a conference in Hamburg in June 1999. The process started with a focus on two fields, "Mobility and Communication" and "Health and Quality of Life". The ministry expected that it would be sufficient to provide a platform and some input on the themes to provoke persons somehow interested in the topics to participate in discussions. This approach failed because too few people knew about the process, and the questions to be discussed were not well defined. Furthermore, the methodology and objectives were unclear, so BMBF decided to re-start the process.

In spring 2001, Futur was re-started, with its methodology and expected outcomes pre-defined by BMBF. The purpose is to work out lead visions as frames for BMBF research policy illustrated by "pictures of the future" or scenarios. The procedure relied on a wider process, using a variety of methods and instruments. It was decided that face-to-face meetings of working groups should be the central medium of discussions, and that the Internet should be used for information, supporting the transparency and communication of the whole process. Futur is demand-oriented, open as regards results and is directly linked to BMBF.

A new consortium (Institute for Organisational Communication, IFOK GmbH; Fraunhofer ISI; Institute for Future Studies and Technology Assessment, IZT; Pixelpark AG; VDI/VDE-Technologiezentrum Informationstechnik GmbH) was responsible for conceptualisation and management of the process. This "new" Futur ran until the beginning of 2003 and was evaluated in Autumn 2002. A continuation of Futur has just been decided. The process is described in more detail in the contribution of Volkmar Dietz in this special issue.

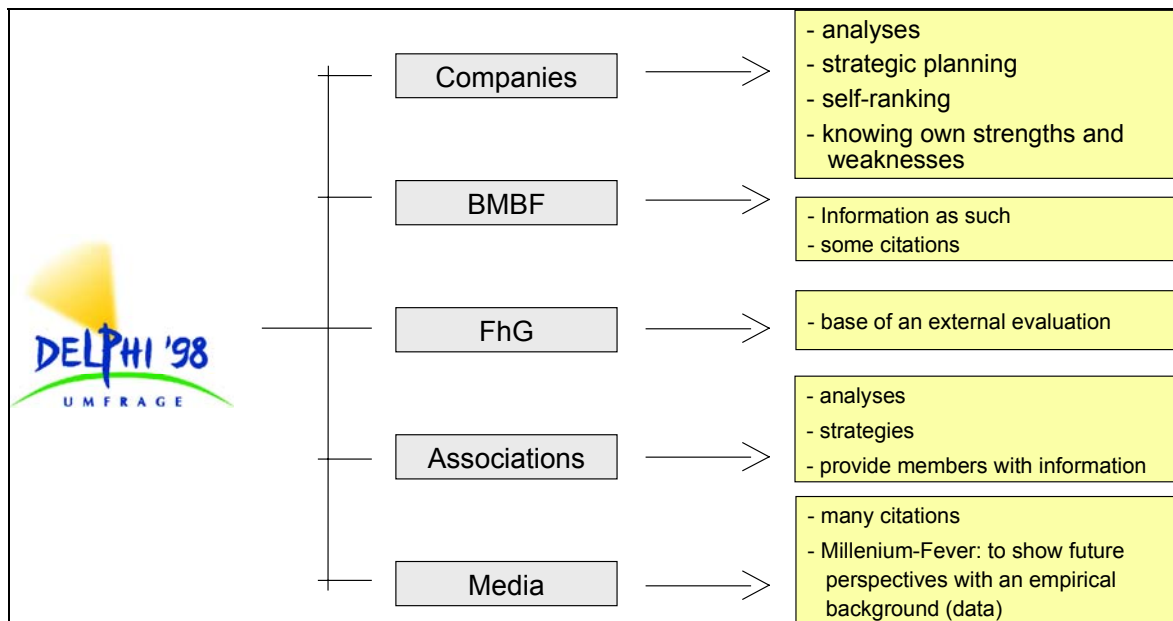
Table 1: Overview of BMBF's foresight exercises

<i>Time</i>	<i>Exercise</i>	<i>Methodologies</i>
1991-1992	Technology at the Beginning of the 21 st Century	relevance tree, critical technologies list, small survey, panel workshops
1992-1993	Delphi '93	translation of the 5 th Japanese Delphi survey, Delphi survey, Japanese-German comparisons
1994-1995	Mini Delphi	expert panels, Delphi survey in a Japanese-German comparison, conference
1996-1998	Delphi '98	expert panels with workshops and virtual work, Delphi survey, analyses, conference about implementation, newsletters
since 2001	Futur	mix of workshop approaches: open space conference, focus groups, futures workshops, scenario writing

2 The Use of Foresight Results in Germany

One main "user" of foresight studies in Germany has until now been the national government (federal level). The results of the survey from 1993 had already contributed to major decisions like some re-orientation in the education and research system, as well as to strategic

Figure 2: The use of Delphi results in Germany



talks between industry and large research organisations. But the regional administrations (the federal states – *Länder*) are also interested in the results; they try to analyse and interpret the data from their point of view (Blind 1997; Schmoch et al. 1995). The results of the Delphi '93 survey were disseminated (for free) as a book and on the Internet so that private actors could also use them.

Some companies started their own investigations to translate the overall national studies for business area and company purposes, both in the manufacturing and service sectors. One large chemical company started with the topics of the Delphi '93 survey, making its own evaluation of the topics and building up a strategy until 2010. The information was discussed and distributed in working groups. Some smaller-scale comparisons of business portfolios in future-oriented areas are also being done in other companies, sometimes assisted by external consultants or researchers from ISI. These activities are largely confidential. In addition, some firms have done their own surveys, one of which has been published (Reiss et al. 1995; Grupp, Reiss 1997).

The company mentioned (Janssen Cilag GmbH) has concluded its own Delphi investigation, surveying the future of physicians in residential areas and their ability to follow modern trends both in medical technology and

pharmaceuticals, aiming to provide information about the health care system. The results of the study which have been summarised elsewhere (Reiss et al. 1995) highlight many different options for the future development of the German health care system.

There were more companies as users of the results of Delphi '98 and, as the year 2000 was close, many people and of course the media wished to know about future developments. Figure 2 shows the different users of this approach (see also Cuhls, Blind, Grupp 2002).

Several lessons can be learned from the application of the foresight activities in Germany. First, the Delphi procedures confirmed very clearly an observation from foreign experience: the process of the survey itself is a very valuable aspect, since a great number of experts is motivated to think critically about future aspects. In particular, it became evident that willingness to participate actively in shaping the future, e.g. of the health care system, is much higher than previously expected. Secondly, for the companies, the benefits of the foresight surveys were not only in gains in information and reputation among their clients, but also extended to the internal situation: the strategies for dealing with challenges of the future became broad company issues which were discussed and supported by many employees of this particular company. Thirdly, the

data gained from foresight activities can be used by many actors both in the private and public sectors.

Therefore, implementation activities were foreseen following Delphi '98, but as the project end coincided with a general election, there were no activities possible. The new government needed time to organise which meant that it was too late for direct implementation in BMBF. And as the project itself still stemmed from the "old government", the current opposition party, it was no priority. In order to start something new and to involve different stakeholders from the innovation system in policy-making, the new process called Futur, the German Research Dialogue, was initiated. But as the main intention of Delphi '98 had been to provide information about the medium- and long-term future, the data were used to a sufficient degree. Even today, there are many persons asking when the next Delphi report will be published.

3 Perspectives of Foresight

As shown in section 2, the implementation and use of Foresight is one of its critical points. When there is no resulting implementation, there are not many reasons to spend money on foresight.

As will be described below, there are various issues that determine the perspectives of foresight. The first is *demand-orientation*, although in most foresight approaches, a mixture of science and technology development push and demand pull orientations can be perceived. The second is the question of the *implementation*. Futur with its demand-oriented approach is directly linked to implementation. BMBF as the financier of the process is directly involved, as the objective of Futur is to formulate application-oriented lead visions. It is too early to evaluate the success of implementation and answer the question if direct priority-setting with a process like Futur is possible. Evaluation until now has dealt mainly with methodological questions.

The third aspect is the question of "neutrality" and *independence* of the process. In Futur, BMBF has been directly involved in foresight for the first time and directly implements its results. In the Delphi processes, it

was only the financier, and more "neutral" organisers managed the foresight process. The consequence was that the sponsor (BMBF) was not the major user, although there was implementation by other stakeholders in the innovation system (Cuhls, Blind, Grupp 2002; Cuhls, Grupp, Blind 1998).

This is very important as foresight ideas are spreading on the regional level. There are of course possibilities to make use of national foresight data at the regional level but also the idea of separate foresight approaches (Gavigan et al. 2001). Until now, not many "successful" regional approaches have been realised so that it is too early to assess whether this trend for regional foresight will be sustainable or if it is just a "fashion". European activities are more complementary (e.g., sectoral surveys). Other types include secondary analyses of foresight processes (e.g., projects of the ESTO network, the IPTS Futures project), methodological exchanges (workshops, conferences, networks) or thematic information gathering projects. To date, there are no comprehensive European foresight activities. These would be difficult to organise and would pose many methodological problems (different innovation systems, languages, cultures, comparability).

Another aspect is the *participation* of new actors in foresight procedures. In the Delphi processes and especially in Futur, persons from different disciplines and thematic backgrounds were already invited to participate. Even the "interested public" could join in Futur. But that does not mean that *more* persons were involved. This is more difficult to achieve in physical workshops than in surveys combined with panels. The identification of persons is increasingly simple but there are more incentives needed to attract those persons whose participation is "wanted". One incentive could be the mutual learning effects for which new information has to be provided. This tendency is being exploited: different groups of persons are to be involved in foresight – more younger persons, more women, more thematic backgrounds. The reason is the assumption that the broader the perspectives of the persons involved, the more ideas can be harvested. But proof for this assumption is still lacking. In those cases, where workshops are the major method, it takes time for people to get to know each other, produce original ideas and

deepen discussion, and this time is not always available. It was also not yet possible to prove that younger persons are more creative.

The *subjects* of foresight tend to be broadened. Foresight in Europe was re-started in the science and technology fields as these are man-made by definition and therefore assumed to be easier to foresee and judge upon. More recently, the impacts of science and technology have also often been the subjects of foresight. Some approaches like Futur try to start from the demand-side, asking the participants what the demand of “society” might be and what kinds of science and technology or education are really needed. Here, the question remains who is demanding what and who the experts involved are.

Foresight is in fashion. But often, the expectations are too high. Foresight processes are often supposed to raise awareness about the future, involve different stakeholders in the innovation system with more and more persons from the interested public, set priorities that can be implemented and at the same time improve communication and create networks. Each goal is valid but here too, priorities must be set. When the new processes do not meet these expectations, foresight is in danger of being a label for different policy-oriented activities. It is difficult to make persons think in the long term, in some fields in particular it is nearly impossible. Doing this systematically is even more difficult (see the definition of Martin 1995). Therefore, one has to be aware that foresight is not a tool for everything and everywhere. Continuity of the processes and updates of information about the future are important postulates in foresight, but are rarely encountered (e.g. in the Japanese Delphi studies).

Foresight can deliver interesting results in the sense of information about the future, help to structure future thinking and give an input to decision-making by a process that involves more actors than before. But if too many actors are involved, it gets trivial and too strongly consensus-oriented. Given time, more objectives like networking, co-operation, and priority-setting can in parallel be targeted at in different international foresights. But this broadens the agenda and if too many objectives are followed, expectations can rarely be met. Clear and concrete objectives are necessary in foresight processes.

It is also helpful to have pragmatic results and not only a process. It has already been noted that the way is the goal, meaning that the process as such is one of the objectives, but that is not enough to convince persons to continue participation or the sponsors to provide a flow of money. The process as such thus has to be transparent for the participants.

Public relations measures and the media are also helpful to transfer results and make the participants aware of such a process. Therefore, in international and German foresight, more integration of the media and public relations work will take place, certainly within limits as PR is relatively expensive.

The process of conducting foresight as such is important to make persons aware of the future (awareness-raising) and help them participate in shaping it. But they also have to be aware that their possibilities are limited – and that in certain fields, future developments will always overtake you. Perspectives for foresight in Germany: the future will never be what you expect.

Notes

- 1) This refers to the use of systematic agreement and consultative procedures to promote greater agreement among scientists, funding agencies and research users on identified R&D needs or opportunities. Meanwhile, it could be observed that already the information whether there is a consensus on future subjects or not is an important one so that in some cases, the fact has to be accepted that it is impossible to achieve a consensus but nevertheless, a decision is needed.
- 2) Advocacy is the deployment of foresight to promote policy decisions in line with the preferences of specific stakeholders in the R&D system. In the famous 5 C's of Martin (1995, p. 141), this is integrated in the term “commitment” in the sense of stakeholders who commit themselves to the promotion of a specific subject.

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Contact

Dr. Kerstin Cuhls
 Fraunhofer-Institut für Systemtechnik und Innovationsforschung (ISI)
 Breslauer Straße 48, 76139 Karlsruhe
 Tel.: +49 (0) 721 / 68 09 - 141
 Fax: +49 (0) 721 / 68 09 - 260
 E-Mail: Kerstin.Cuhls@isi.fraunhofer.de
 Internet: <http://www.isi.fraunhofer.de>

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