Corporate FTA  
(Future-oriented Technology Analysis)

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1. INTRODUCTION

This paper addresses Foresight and Future-oriented Technology Analyses (FTA) in the context of their application to the world of business. While there has been a great deal of emphasis on the development and use of FTA in the public sector and by governments, less attention has been directed to the substantial growth in foresight and future analysis in business.

However, on closer inspection, it has become apparent that the term Corporate Foresight (e.g., Burmeister/ Neef/ Beyers 2004) is commonly being used to describe very different things. In order to clarify the term, and identify its various uses, this paper has been structured to address separately 'FTA in business' and 'FTA for business'.

A short overview of the historical development of FTA is provided first, to set the scene for the more detailed analysis of the different objectives and potential impacts of FTA in the business sector.

2. HISTORY OF CORPORATE FTA

The drive to understand and reveal the future is almost as ancient as human history and human inquiry. All cultures and civilizations have produced their prophets, seers, oracles,
shamans or ‘witch doctors’, seeking insights through stars, animal entrails, cloud patterns, seasonal variations or hallucinogenic experiences. Indeed, it can be postulated that notions of past and future are an integral aspect of ‘homo sapiens’ and our own remarkable evolution.

In the 1950s the US Department of Defense, looking at the development of new weapons systems, faced two specific needs:

'the need for a methodology to capture the reliable consensus of opinion of a large and diverse group of experts and the need to develop simulation models of future environments which would permit various policy alternatives and their consequences to be investigated'. (Bradfield et al, 2005)

The first led to the Delphi technique, the latter to systems analysis and scenario planning, developed within the RAND Corporation.

However, it was the particular conditions of the 1960s that gave birth to the contemporary form and practice of foresight. The demonstrated effectiveness of operations research, leading to the growing influence of systems theory and thinking, together with the strategic challenges of the Cold War, provided a climate in which organised thinking about the future flourished. In contrast to the nineteenth century theories of social change, which dealt with large impersonal processes of evolution, the new approach was based on the deliberate intervention to direct change for specified ends.

In France, the Futuribles project was launched. In the UK, a ‘Committee on the Next Thirty Years’ was established. In the US, Herman Kahn left the RAND Corporation to establish the Hudson Institute, where he initiated a series of major studies on the future addressing economic and social policy issues, as opposed to his previous military focus.
Daniel Bell (Kahn and Wiener, 1967, p.xxv) attributed this emergence to the effects of economic recovery and growth:

It arises from the simple fact that every society today is consciously committed to economic growth, to raising the standard of living of its people, and therefore to the planning, direction and control of social change. What makes the present studies, therefore, so completely different from those of the past is that they are oriented to specific social-policy purposes: and along with this new dimension, they are fashioned, self-consciously, by a new methodology that gives the promise of providing a more reliable foundation for realistic alternatives and choices, if not for exact prediction.

And the new methodology?

We have begun to assemble statistical time-series both to plot trend lines and to extrapolate likely developments. The existence of a trend is no necessary guarantee that it will continue; but knowledge of trends and curves gives us more knowledge of likely developments. Along with time-series, we have begun to construct models or likely combinations of trends and developments in order to uncover the connections and causal relations between variables. And finally, with such simple techniques as the Delphi method, we seek to impose some controls by checking the informed guesses of one set of observers with those of others. (Kahn and Wiener, pp. xxvii-xxviii)

Kahn was appropriately prosaic in addressing the question of why we should speculate far ahead. Not because we could predict the future, but because:

such studies, even if only partially successful, contribute to interesting lectures, provocative teaching and stimulating conversation, all of which can broaden horizons and increase creativity – by no means negligible benefits. More important, these studies can affect basic beliefs, assumptions and emphases. Probably most important, is that long-range studies
provide a context in which to do five- and ten-year studies that can and do influence policy choices. (Kahn and Wiener, p.1)

While the initial focus was on public policy, it soon attracted the interest of the business community. Royal Dutch Shell initiated a 'Year 2000’ study in 1967, which identified that the historical trajectory of year-on-year expansion could not continue, and that the oil industry faced a discontinuity. Pierre Wack, a planner at Shell Francaise, who was familiar with Kahn’s work, proposed:

to experiment with scenario planning as a potentially better framework for thinking about the future rather than continuing to rely on conventional forecasts which were likely to be wrong in the face of a discontinuity. The initial scenarios developed in 1971 …proved extraordinarily successful in that they correctly identified an impending scarcity of oil and an ensuing pointed increase in oil prices; shortly thereafter scenario planning was extended throughout the company. (Bradfield et al, 2005, p.798)

Companies were also included in the national forecast (today we would say foresight) activities in the USA. (Gordon and Helmer 1964) or in Japan (Kagaku Gijutsuchô Keikakukyoku 1971). This was also the time when the first scenario approaches were tested (Kahn, 1968). It is reported (Bradfield et al, 2005, p.798) that General Electric also produced four alternative scenarios in 1971 of the global and US economic and socio-political conditions in 1980.

The growth in the application of foresight in the corporate sector was apparently quite strong during the 1970s and early 1980s, and is well-documented. A survey of US companies in 1981 found limited use prior to the oil crisis of 1974, but a substantial surge after that date, such that by the early 1980s, almost half of the US Fortune 1000 industrial companies were actively using foresight techniques in their planning processes. The companies using foresight were characterised by their large size, planning horizons of more than 10 years, and capital intensity, as in the
aerospace, chemicals and petroleum industries. (Linneman and Klein, 1979, 1983)

The pattern of adoption of foresight in planning was largely similar in European companies. Malaska et al. (1984, 1985) reported a period of experimental adoption of foresight techniques after 1973 and strong growth between 1976 and 1978, mainly on the part of large companies in capital intensive industries with long planning horizons such as petroleum, motor vehicles, and power supply.

The use of foresight by companies over the rest of the 1980s presents a confused picture. On the one hand, Bradfield et al suggest 'there is anecdotal evidence to the effect that scenarios declined in popularity during the 1980s' and cite Martelli’s (2001) suggestion 'that while the use of scenarios comes and goes in waves, it has grown in the last one or two decades but not that much and probably less than expected'.

On the other hand, the UNIDO Technology Foresight Manual (2005) reports:

In the last two decades several large enterprises in such diverse sectors as energy, automotive, telecommunications and information technology have established foresight groups and strategic planning processes, which analyse the long-term prospects of new technologies and their impact on markets and corporate strategies. DaimlerChrysler’s Society and Technology Research Group (STRG) is one of the first future research groups to be established within a company. Since 1979 it has investigated, in close cooperation with its customers, the factors shaping tomorrow’s markets, technologies and products.
A survey of 18 major European firms with substantial R&D budgets in highly competitive sectors\(^1\) (Becker, 2002) revealed that all were engaged in foresight, with a focus on technology trends, or market trends, or both. There were two principal reasons given:

- either they are a consequence of a companies’ business operation which inherently demand such a long-term orientation (as in industries with long product cycles), or they are undertaken as a proactive step to better cope with uncertainties in the business environment in general.

In the 1990s, as national governments became more active in foresight, large companies such as Philips, Lucent Technologies, Siemens, DaimlerChrysler and of course Shell had already developed their own systems of looking into the future and drawing conclusions to feed into their planning.

The methods of choice were based on patent analysis, literature analysis, scenarios, surveys, sometimes even in the form of a Delphi, and technology roadmaps (Reger et al. 1998). The most popular of these techniques with business were roadmaps and scenarios.

Since then, the use of foresight has spread around the world. Networks and alliances were established to facilitate this, such as EIRMA (European Industrial Research Management Association) in Europe and the Global Business Network in the US.

It should also be mentioned that management consultants turned their attention to foresight in the mid-1990s. Whereas previously, the dominant management approach had been that of strategic planning, with a time horizon commonly of one to three years, writers such as Hamel and Prahalad (1994) emphasised the need

\(^1\) Companies like DaimlerChrysler, Ericsson, Aventis, IBM, Philips, Siemens, BASF, Volvo, BT.
for companies to play a role in inventing a longer-term future in which the organisation would have competitive advantage.

Since then, the growth in the number of consulting companies offering services in foresight has been considerable. Another indication is the growth in the number of conferences and workshops about 'Corporate Foresight'.

3. TYPES OF CORPORATE FTA

Corporate FTA covers a wide range of different types and approaches to addressing the future. Projects differ in methodology, size, concepts, understanding of the time horizon and objectives, as well as the impacts they might have. In this overview paper we distinguish two major categories: firstly, future-oriented technology analysis in business, performed directly in companies for various purposes, and secondly, FTA for business, performed by various actors, and applied in business.

3.1 FTA in Business

FTA in business is conducted inside a company, in most cases by the company itself, though sometimes assisted by external facilitators or advisors. One challenge in identifying foresight in business is the variability in usage of terms: foresight and forecasting are frequently used interchangeably, or not used at all in favour of the more familiar strategic planning and management vocabulary. Some applications of foresight in business are:

3.1.1 Foresight for strategic planning

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2 A Google search of foresight produces some 22 million items, with a substantial proportion from consultancies.
Foresight and future-oriented studies are commonly performed in companies that have their own strategic (planning) departments. These are usually larger companies such as Siemens AG, DaimlerChrysler AG, BASF AG in Germany, Lucent Technologies in the US, Nokia in Finland, or Philips in the Netherlands.

A number of broad generalisations can be drawn. First, in many cases, scenario planning approaches from the different 'schools of thought', such as Godet (1997), the US Global Business Network, the 'Nixdorf School' (Fink/ Schlake/ Siebe, 2001), Ringland (1998), Schwartz (1991), Van der Heijden (1997) or von Reibnitz (1988), are applied. Second most of them integrate a form of cross-impact matrix, and examine drivers, influences, key factors, or visions of the future. Third, in most cases, alternative scenarios are developed (eg best versus worst case, different options). Some work with a single normative scenario that is directly applied as a 'vision' in the business context. Fourth, the results of these activities are generally directly used for strategic vision building or planning, are performed directly in the company, and usually have a direct internal impact. As an in-house activity, the process is often as important as the results.

There are also many future-oriented projects conducted in R&D strategy departments or other divisions related to innovation. Often, these projects are not called foresight at all but labelled 'long-term strategy planning' or 'studies for long-term anticipation', 'strategische Früherkennung' or even equivalents of the word 'forecasting'. Nevertheless, it is clear that these analyses fit under what we call FTA.

Many companies also try to gain an overview and 'to better understand the social and cultural context of the use of technology. Firms in particularly technology-intensive sectors (Philips, Ericsson, IBM, Siemens) also use foresight more broadly to build up knowledge both about emerging technologies and their future users. (Becker, 2002, p.9).
3.1.2 Foresight for marketing

While less common, foresight for marketing has been used to raise general societal issues by companies like Janssen Cilag (health), or Siemens AG (Horizons, Pictures of the Future). These activities are used to position the company as a 'responsible partner in society'. The impacts of these activities on the company or society are difficult to evaluate but nevertheless real.

Other FTA activities are also conducted in the marketing departments of large companies, often under different labels. Some companies look for 'social innovation' (German Telekom), trends in consumer behaviour, new patterns of consumerism (like 'event consuming') or the needs/demands of people in general. These approaches are mainly short-term and can be found in nearly every large marketing department. Internal and external data about customers are often analysed for this purpose. Some companies analyse these data further and with a longer term view, in order, for example, to develop new products. (Kondo, 1993)

In 1998, we performed interviews in German, Japanese and US companies (Reger et al., 1998) about their foresight activities. In two Japanese companies, we found a system that connected the marketing and R&D departments directly in order to identify long-term weak signals on the one hand, and analyse customer behaviour, needs and claims (if something went wrong) on the other. In one of the companies, a product could be identified that was directly derived from the wishes of the customers, and had been a huge market success not only in Japan.

3.1.3 Foresight for organisational change
In some cases, companies engage in foresight to provoke organisational change. In most cases, the aim is to restructure the internal organisation in order to position for possible events to come. However, as in so many cases of organisational change management, internal resistance to change is so strong that there is limited impact. An example is German Telekom (Reger et al. 1998) which aimed to install a foresight system but concluded that there was already a significant level of foresight being conducted under various names.

Organisational change needs a lot of internal knowledge and the persons involved in performing such a foresight process often need to work locally in the company. Without being integrated for a certain time in the organisation and without building up 'trust', the impact can be very limited. This is for example the philosophy of DaimlerChrysler's future group (Society and Technology Research Group) in Berlin.

3.1.4  Foresight for innovation

A number of larger companies, such as Hewlett-Packard, Intel and Google have pioneered the use of 'predictive markets' as a way of tapping and applying the knowledge and experience of all their staff in making judgements, through a virtual trading mechanism, about likely future directions of technology development. (see for example The Foresight Exchange Prediction Market). With the current technical means to support such analyses, this is a rather new development and only few impacts can be observed until now.

Other companies perform innovation foresight as a prerequisite for their own strategic planning (Philips). Some firms regard the catalytic function (see below), to stimulate and enhance their innovation processes, as important. Becker (2002, p.10) mentions DaimlerChrysler, Philips and Decathlon in this context.

3.2  Foresight for Business
This second category involves the application of the results of foresight activities performed outside a particular business. Here, often, the activities are not directly tailor-made to the objectives of the companies but they are nevertheless used internally or for business purposes. These kinds of activities include:

3.2.1 Making use of the results of national and other public foresight activities

One of the most popular approaches is using data (e.g. surveys, Delphi results) from national foresight activities for business and especially for strategic planning purposes. Japanese companies have reported effective use of the results of the regular NISTEP Delphi reports (NISTEP, 2004). Similar findings have been made for German industry (Cuhls/ Blind/ Grupp, 2002). Only in Japan, a series of foresight activities can be found that provide data directly, and on a regular basis, for external (business) use. In all other countries, the public foresight projects or programmes do not run in such a continuous way or are performed with a more process- rather than output-oriented methodology (like in the German Futur, the UK Foresight etc.).

But as the data are more general in nature, they have to be adapted to the different users and purposes. For sectoral analyses, the relevant data have to be searched, selected, assessed, and then have to be qualitatively transferred into the context. Even for gaining an overview, they have to be clustered or processed in a way that the overview is adapted to the context and objectives. Otherwise, no impact can be achieved.

3.2.2 Foresight by Industry Associations
Industry associations have conducted foresight exercises or analysed the results of national foresight activities for their members; e.g. the German ZVEI (electro technical association) and the VDMA (machine tools). Currently, the VDMA is establishing a 'manufacturing platform' to provide information for their members. An influence from the international project ManVis (www.manufacturing-visions.org) can be observed in this case.

An interesting case is the organisation of a foresight project on the future of housing by the Copper Development Centre (2004) – the peak body for the copper industry in Australia and New Zealand. The project, which involved, visioning, scenario planning and roadmapping was initiated in an effort to develop a broader understanding of how residential housing was likely to change over the next twenty years and to provide a framework for adapting strategically to these challenges and opportunities. The project was targeted at those companies that are involved at any stage in the value chain of housing construction and services. CDC has subsequently used the results of the project to trigger 'new product/service exploratories' with key companies at appropriate positions in this value chain.

3.2.3 Foresight by Foundations

Foresight by Foundations is normally targeted at setting priorities or providing information for society (e.g. European Science Foundation) or for companies, particularly small and medium-size enterprises (SMEs). The German Stiftung Industrieforschung, which provides money for research institutions that work with SMEs, performed two foresight projects to identify interesting thematic fields. In two survey rounds, new fields and research topic were identified and then assessed according to categories of importance and if the companies would invest in the topic themselves. Based on the survey results, 'interesting' themes were selected. In these fields,
interviews were performed to gather detailed information about the research questions that are relevant for the future and fit into the funding portfolio of the Foundation. From the results, 10 topics were selected for support in the following year. The topics were e.g. laser diode systems and medicine technologies. The impact here was in the setting of priorities, a direct call for applications, and in the consequential research results.

3.2.4 Multi-client studies

There is also potential for foresight as a multi-client study. These studies are often financed by the companies themselves or by e.g. a ministry, the European Commission or an association (see above) to promote future developments. An example is 'HyWays', an international consortium to promote hydrogen infrastructure. In the project, a validated and well-accepted roadmap for the introduction of hydrogen in the energy system is being developed. Companies like Air Liquide, the BMW Group, Det Norske Veritas, DaimlerChrysler AG, Total, GM Opel, Vattenfall Europe and others are participating as well as a range of institutes. The Member State Representatives are from the French Atomic Energy Commission, the Italian National Agency for New Technologies, Energy and Environment, the German Energy Agency, the Hellenic Institute of Transport, Senter Novem and the Western Norway Research Institute.

In these cases, there are direct impacts on companies because the objectives and methods of the studies are tailored to their needs. On the other hand, this is only possible, if the questions asked are

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4 More details can be found at: www.hyways.de.
relatively clear and if the need for information is recognised in the specific field.

4. OBJECTIVES AND METHODS OF FTA IN AND FOR BUSINESS

Five major objectives of corporate FTA have been identified (Becker, 2002, p.9):
- anticipatory intelligence, i.e. providing background information and an early warning of recent developments;
- direction setting, i.e. establishing broad guidelines for the corporate strategy;
- priority setting: i.e. identifying the most desirable lines of R & D as a direct input into specific (funding) decisions;
- strategy formulation, i.e. participating in the formulation and implementation of strategic decisions;
- innovation catalysing, i.e. stimulating and supporting innovation processes between the different partners.

However, sometimes the aims are even broader (Cuhls, 1998; Burmeister/ Neef/ Beyers 2004). The impacts of the processes of FTA studies are accordingly different.

The way the FTA function is organised in companies, also varies a great deal. Becker (2002, pp.12f.) identifies three approaches: 'The Collecting Post' with limited but integrated capacities which provides background information for decision-making processes,
'The Observatory' is an autonomous foresight unit, with staff and a budget of its own focussed on highly specific company objectives, and 'The Think Tank', which operates fairly independently across a wide range of areas. Applying this classification and drawing on literature analysis and our own interviews, we have classified a number of international companies according to their relative focus on external information gathering versus internal change. (Figure 4-1).

Figure 4-1: Internal versus External Orientation of Business Foresight
In the above mentioned survey for the German Telekom in 1998, in which US, Japanese and German companies with foresight activities were identified and interviewed, it became obvious that the terminology for foresight and FTA is diverse but the methodologies used are often the same. The following methods were identified (Reger et al., 1998; see also Burmeister/ Neef/ Beyers, 2004, p.37 and Schwartz, 2006):

- patent analysis
- publication analysis
- market analysis, environment analysis, trend studies
- extrapolations
- competitive reports and benchmarking analyses
- competitive intelligence
- systematic customer surveys
- 'intelligent' cost analysis
- co-wording/ co-heading analysis
- risk analysis
- simulations
- life cycle analysis
- internet search systems and engines
- technology mapping
- expert surveys/ Delphi surveys
- relevance tree analysis
• portfolio analysis
• scenarios
• future labs
• future workshops
• future conferences
• technology or product roadmaps
• creativity methods (brainstorming, meta-plan, mindmaps)

Various authors (e.g., Burmeister/Neef/Beyers, 2004, p. 37; Schwartz, 2006; Cuhls and Kuwahara, 1994; Reger et al., 1998) have indicated that trend and environment analyses, creativity methods, scenario methods, and expert surveys (including Delphi surveys) are the most commonly used tools for FTA in firms. Trend extrapolations are also applied but must be carefully analysed, to identify when the trend might break. In companies, the classical and rather quickly performed analyses of publications, of product life-cycles and of business portfolios are still the standard whereas more time- and resource-intensive methods are less common. Although some companies prefer the long-term view, the most commonly found approaches are short-term.

In the US and Japan ten years ago (Reger et al., 1998) it was evident that roadmaps were much more recognised as an FTA tool than in Germany (and other European countries). There is evidence that this has substantially changed, with a number of roadmapping projects completed or in progress. A Delphi survey by Schwartz (2006) about the application of FTA methods in corporations points to an increase in applications. This can also be interpreted as a sign that FTA is being more directly integrated in companies.

If scenario methods in their different variants are applied, 'wild cards' (Steinmüller and Steinmüller, 2003) are commonly considered to prepare for unforeseeable events, 'think the unthinkable', and prepare for a worst possible case. This is an
addition to many scenario processes and generates more sophisticated surprise-connected scenarios as well as policy recommendations.

The different methods have their different objectives, applications and therefore impacts. At this stage, it is premature to attempt to identify best and worst practices. What is clear is that the methodology has, as in all FTA exercises, to be specifically tailored to the objectives of the company, and the future issues of interest.

5. IMPACTS OF CORPORATE FTA AND OUTLOOK

It can be concluded that there has been a very substantial growth in the application of FTA in the business sector, with a range of diversified impacts. In some cases, direct consequences flow from the foresight: e.g. new business areas, new products, new production procedures, new strategies and targets, and new forms of organisation.

The different methods applied in business and for business lead to different applications and impacts. But the consequence is that it is very difficult to trace the different results back to the different outputs of FTA studies because there are so many intervening factors involved. Process-orientation, as an essential part of FTA activity can also be an integral and important aspect, because this has a direct impact on the people in business, their culture, and their behaviour. This is not only true for the decision-makers but all persons involved in the process.

There remain many opportunities for the more extended application of FTA in the business sector. In the traditional area of strategic planning, FTA approaches have much to offer in the development of visions and goals, in the analysis of the environment external to the organisation and the opportunities and threats it may pose in the future, and in the development of
strategic intelligence. In risk management, there are enormous opportunities for the better identification of potential future risks, and of the stakeholders who may be affected. Even in change management, as we have noted, developing and communicating a clear image of the future and using the group processes of FTA to motivate changes in behaviour offer considerable potential.

The major difficulty remains that of demonstrating unequivocally, and preferably quantitatively, the impact of an FTA study in or for a company. The process benefits in certain cases are clearly demonstrable, but often fail to persuade more 'bottom line' focussed companies. In business, everything has to be judged on the basis of money or other added-value that can be quantitatively measured. Some companies already have a system for this. But these are mainly larger companies which have already acknowledged that FTA might be an add-on and that the company itself might profit from it even if the quantification is weak. Here, there may be opportunities for learning from the experience of foresight evaluation. However quantifying the precise benefits will probably remain a long-term goal.
References


