Taking advantage of foresight studies' outcomes to SUPPORT strategic decisions in Corporations

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Please cited as: CHEMIK 2010, **64,** 6, 440-450

Introduction

Sophisticated nature of technological, social, economic or political processes inevitably entails the ability to predict them. The need to find the ways to determine possible future events led in the 60's of 20th century to the development of a new methodological approach, referred to as the *foresight* process. On its early stage it was limited to only two popular methods, i.e. the scenario building and Delphi analysis (cf. Turoff & Linstone, 1975). Attempts to find out new and general methods to predict possible future events taking into account unexpected disturbances were even strengthened after the publication of catastrophic reports submitted to the Council of the Club of Rome. Due to the loss of confidence to forecasting methods that were available at that time and based exclusively on contemporarily known statistical methods, it proved necessary to extend the scope of research methods to the development of a holistic vision of future. Initially, foresight was dedicated to create a future image of a country or a sector of technology, while nowadays it is getting more and more popular on lower levels, as it descends to regions, or even corporations and individual topic-related processes. The reverse direction is also witnessed, where European or even worldwide foresight is also applicable. The results of foresight exercises are expected to be a methodological base to draw up priority directions for development in accordance with the adopted vision of future.

A continuous extension of the scope of foresight studies encourages investigation of practical opportunities offered by their results. Polish industry and researchers are already given an opportunity to take advantage of results from several dozens of foresight projects dedicated to technological, sector or regional studies, most of them financed from the EU Operational Programmes: Increased Competitiveness of Enterprises, sub-action 1.4.5 (the execution period from 2005 to 2007), Innovative Economy - Sub-action 1.1.1 (implementation of projects since 2008) as well as of the National Foresight Programme (results published in 2008 and 2009) and – to a lesser extent – of the Operational Programme Human Capital.

Foresight is the process of strategic mental approach that precedes development of long-term strategic plans. The latter procedure is often carried out according to the rules typical for so-called roadmapping (see Skulimowski, 2009), which include taking advantage of foresight results. Based on current state-of-art in science, technology economy, social awareness as well as their mutual interconnections, foresight allows to reach information necessary to create mid- or long-term visions of future, its multidimensional character and hierarchic priorities.

During the last two decades foresight has become a popular method used to develop policies of the European Union, where the following motivations to launch foresight studies could be found out:

- criticism and rejection of the approach where only statistical prediction methods were used to forecasts the future
- an increasing role of EU regions: continuously growing range of competences assigned to regional authorities, acquisition of EU support funds, creation of social and economic growth, and connection between national and local levels
- the need to use management instruments appropriate to the altered administration model and to choose optimal directions for regional development (EU, country, sector, corporation).

Sector foresight is getting more and more popular and presents a key for further growth of specific business types. It covers projects intended to draw up a systematic vision for development of each specific economic sector with the aim to find out key factors that may possibly play an important role for growth of this sector.

A particular reason to develop foresight projects for the chemical industry is the need to carry out restructuring of this sector that is under a threat of incompatibility to the present or future standards of the EU environmental policies. An example of such endeavour is the recently launched project dedicated to the Polish inorganic chemistry sector, i.e. 'The technological foresight of inorganic wastes of chemical industry" (www.inorganicwaste.eu). Such projects itemize threats to further growth caused by incompatibility of technologies and organizational structures to the standards of acquis communataire and worldwide competition. Their results should include necessary information to draw up strategies for further development and to implement adaptive mechanisms to retain or restore competitiveness of the involved enterprises.

An implementation of results of sector foresight and technologically-oriented regional foresight studies in business practice of corporations, in particular those from the chemical sector, is essential to preserve their competitiveness on global markets. In particular, an awareness of future development alternatives helps to set up priorities of technological development as well as the directions of industrial research, priority investment in innovations, marketing, and infrastructure. The foresight methods make it possible to take into account the synergies with social, economic and political issues, environmental and technological constraints, and research opportunities.

Technological foresight in Poland

The Polish National Foresight Programme has been initiated in 2003 by the Ministry of Science and Information Technology. The first area investigated was called "Health and Life", covering the medicine, pharmacy and life sciences. It was followed by regional and sector projects carried out from 2005 onwards within the Sector Operational Programme Increased Competitiveness of Enterprises (SPO-WKP), Sub-Action 1.4.5, then by the National Foresight Programme in four further areas, and by over 20 projects financed within the Sub-Action 1.1.1 of the Operational Programme Innovative Economy (POIG) during the period 2008-2013.

The foresight exercises carried out in Poland so far use most heuristic methods that became international standards, such as the Delphi method (Grupp, Linstone, 1999), panel studies, morphological analysis etc. Among the original methods developed in Poland one should mention the SWOTC analysis, which is a practically oriented extension (cf. Skulimowski, 2006) of the commonly known SWOT method. It differs from the conventional SWOT by the introduction of Challenges that represent exogenous factors that shall be effective in future and may

convert in both threats or opportunities depending on decisions or events that are uncontrollable by the decision-makers. The simplest form of the SWOTC method assumes development of a five-box table where strengths, weaknesses, opportunities, threats and challenges are itemized. The SWOTC method enables to easily switchover from the phase of analysis to the phase when strategic plans are developed.

The quantitative methods of foresight used most frequently in Polish exercises include analysis of trends that consists in identification and quantitative description of core trends that substantially affect operating conditions of corporations (sectors, regions, countries). Specific methods intended to analyze trends include the *trend-impact analysis* when impact of various events onto trends is examined as well as the method intended to check mutual influences of trends, sometimes referred to as the *cross-impact analysis*. The subsequent development of scenarios is a foresight stage where expertise acquired on the earlier stages of the foresight process can be applied. In addition, it serves as a tool to support strategic decisions and to cast light on feasible choices and their possible consequences.

The anticipated applications of foresight in Poland include the national, regional and corporate strategic management. Strategic planning needs frequently to deploy technological and investment priorities, preferred directions for development and market expansion as well as other strategic objectives. Priorities define also the time order of the tasks or projects to be executed. Those with higher priority are implemented earlier as they are more important, those with lower priorities can be postponed. It is why the rules that define how to assign priority rights must be established whiles adherence to such rules is referred to as the process of dynamic prioritization (Skulimowski, 2008).

The following workflow rules can be proposed to sort out priorities from the specific areas:

- Analysis of results from various foresight studies, carried out at the regional, local or content-related (sector) level
- Based on the preceding step one can select core technologies, key sectors and investments, and other operations. These are positioned on the list where the order numbers are assigned in accordance with the weight coefficients which, in turn, are calculated on the base of their frequency of occurrence in reports from foresight studies, positions on lists for individual projects and trustworthiness coefficients of these projects
- Next, the list is developed for priority sectors, actions, investments, products, processes whereas rank positions can be determined based on weight coefficients
- Verification of the analyzed projects against synthetic lists of priorities – results of the foresight studies (setting up of the new criterion 'fulfilment of recommendations' from the foresight studies
- Establishing a set of reference points using the method described in (Skulimowski, 1997), where the points are associated with scenarios developed for foresight projects (optimistic scenario – the class of ideal points, neutral scenario – status quo points, pessimistic scenario – anti-ideal points, etc.). For each object that is subject to analysis it is necessary to check its position in the relevant scenario, find out the closest available reference value and classify them appropriately. The best objects are chosen for implementation.

When the above method is used one has to keep in mind that the data quoted in scenarios must be linked with assessment criteria of technologies, options of investments, R&D projects, in particular with their economic and environmental parameters.

The important aspect that makes it possible to take advantage of results from foresight projects financed from public funds in Poland, including the ERDF, is conformity of the projects with the strategic directions of EU policies and with the National Strategy of Cohesion (NSS) for the years 2007÷2013. A concordance between corporate priorities and priorities defined in foresight studies should thus facilitate co-financing of private development projects from EU funds. For instance, the National Foresight Program 'Polska 2020' (www.polska2020.pl) in its part associated with the technologies for environmental protection identifies the following trends and phenomena that are relevant for the chemical sector:

- increasing demands for environmental technologies shall enforce application of cutting edge technical achievements to create new generation of measurement systems for monitoring the environment and for supervision of technological processes
- the environmental technologies shall increasingly benefit from IT that enable permanent monitoring of environmental parameters
- abiotioc methods (physical and chemical ones) that are currently used to improve condition of the environment shall be widely substituted by biological methods (e.g. fitoremediation, bioremediation, bio filters, bio barriers)
- hazards to human health and ecosystems shall be substantially reduced due to development of technologies intended to mitigate uncontrolled release of hazardous substances and limitations to the circulation of such substances in the environment
- development of clean technologies that produce little or no waste as well as new methods of utilization of waste
- a reduction of the amount of industrial waste shall be achieved owing to development of alternative low-waste technologies suitable for the sector of small and medium-sized enterprises as well
- advanced equipment and processes for new generations of zero-emission or low-emission technologies.

The following Table 1 contains a list of sector foresight projects carried out in Poland, which partial results are already available for the stakeholders involved. Full reports from all these projects have been submitted to the Polish Ministry of Science and Higher Education (MNiSW) and can be requested from there.

Besides the projects that are summarized in Table 1, there were also eight projects of regional foresight completed within the ERDF-financed Operational Programmes Increased Competitiveness of Enterprises (SPO-WKP) and directed to technologies of sustainable development. Moreover, about 20 projects of sector foresight are currently (2010) in progress within the Sub-Action 1.1.1 of the Operational Programme Innovative Economy (POIG). Their results shall be available between 2010 and 2012. It is necessary to keep in mind that organization that run projects within POIG Sub-Action 1.1.1 are obliged under terms of their agreements with the Contracting Body to disseminate results among all the stakeholders under equal terms.

The past experience with the scope and execution of sector foresight programmes in Poland can be summarized in the following way:

- the number of sector foresight projects as well as number of sectors covered by the foresight programmes is still relatively scarce
- research and development organizations play the dominant role among project partners (imposed by terms of the POIG 1.1.1 contests)
- leading organizations are headquartered only in few research centres (Warsaw, Upper Silesian agglomeration, Kraków)
- applicable methods are frequently selected under random rules, without a sufficient justification
- the projects demonstrate similar duration and time horizon (usually between 2020 and 2030)
- most projects are focused on the identification of core technologies.

Conclusions

Application of results from foresights studies to the corporate practice is not an easy process that needs usually collaboration with external experts. The major area where results from foresight studies can be applied in chemical companies is the development of strategic plans, whereas the technological roadmapping is the process that can

Table 1

Sector foresight projects completed within the Sub-Action 1.4.5 of the SPO-WKP

No	Project title	Project budget (PLN)	Duration	Website	Disseminated results
1.	Technological foresight for polymers	5 300 000	05.2006 ÷ 05.2008	http://www.foresightpolimerowy.pl	The website contains description of the project with topic-related areas
2.	Scenarios for technological development of the industry involved in extraction and processing of brown coal	**6 000 000**	**06.2006 ÷ 05.2008**	http://www.igo.wroc.pl/foresight/foresight.html	The website contains the project management diagram and the list of tasks
3.	Scenarios for technological development of the industry involved in extraction of hard coal	3 670 000	07.2006 ÷ 06.2008	http://www.foresightweglowy.pl/	The website contains the project management diagram, slideshows, database of technologies. Sixteen studies and 19 reports were published without literature references (status for 16th February 2010).
4.	Scenarios for the development of technologies dedicated to modern ceramics, metallic and composite materials	3 390 000	06.2006÷ 10.2008	http://www.foremat.org, www.nanonet.pl, http://intranet.unipress.waw.pl/FOREMAT	The websites contain description of the project, methodology, positioning of technologies, 2nd volume of the report, questionnaires, and statistic instruments. Published output: the monographic study with results of the project.
5.	Assessment of prospects and benefits from application of sky satellite technologies and growth of space technologies in Poland	1.3 m	01.2006 ÷ 06.2008	http://www.kosmos.gov.pl/index.php?link=94&page=0	The website contains the project management diagram, slideshows and report for the 1st phase of the project, the catalogue for application of space technologies in Poland
6.	Directions for the development of technologies for needs of the avionic cluster "Avionic Valley"	298 000	11.2006 ÷ 05.2008	http://www.dolinalotnicza.pl/en/12/12/art21.html	The website contains description of the project and list of core technologies
7.	Scenarios for technological development of the industry involved in extraction of copper ores and accompanying raw materials in Poland	3 500 000	07.2006 ÷ 06.2008	http://foresight.cuprum.wroc.pl/	The website contains description of the project, database of technologies with relevant descriptions
8.	The monitoring system and scenarios for the development of medical technologies in Poland	1 980 000	07.2006÷ 06.2008	http://biomed.eti.pg.gda.pl/rotmed/	The website contains out-of-date links to the Project results (access attempt on 17th February 2010)
9.	Scenarios for technological development of the fuel and power engineering cluster to safeguard energy supplies for the country	3 100 000	12.2005÷ 11.2007	http://www.foresightenergetyczny.pl/dokumentacja.html (information of the subsequent project is on the homepage)	The website contains two reports, currently information of the subsequent project is on the website http://www.foresightenergetyczny.pl Published output: two monographic studies

Source: Centre of Decision Sciences and Forecasting (CNDP), www.foresight.pl

explore foresight results to a full extent. There are two possible application approaches but they are not separated and can even overlap one another.

- taking advantage of external research studies that are completed for a specific sector, region or the entire country

and

- own corporate foresight that consists in systematic, participative development of visions dedicated to a specific company or a group of them, with identification of key factors that are most important for the development of long-term corporate strategy.

In every case the results from foresight studies are used to do draw up strategic directions for business activities and investments of the company and to define future challenges with regard to innovations. Such efforts can allow the foresight-aware companies to achieve a long-term advantage over the competitors.

Acknowledgement

This paper has been developed within the research project "The technological foresight of inorganic wastes of chemical industry" financed within the Sub-action 1.1.1. of the Operational Programme Innovative Economy, project number WND-POIG.01.01.01-00-009/09

English translation by the author.

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Conferences 2010

Royal Australian Chemical Institute's National Convention, RACI 2010 and the 12th IUPAC International Congress of Pesticide Chemistry
4 – 8 06 2010, Melbourne
http://www.iupacicpc2010.org/

POLYSOLVAT
8 Polymer-solvent Complexes and Intercalates
5 – 8 06 2010, Strasbourg
http://www-ics.u-strasbg.fr/~polysolvat/

20th International Conf. on Spectral Line Shapes
6 – 11 06 2010, John's
http://www.icsls20.ca/

Second Regional Symposium on Electrochemistry
6 – 10 06 2010, Belgrad
http://www.rse-see.net/

XXIII IUPAC Symposium on Photochemistry
11 – 16 06 2010, Ferrara
http://web.unife.it/convegni/iupac-photochem-2010/index.php

MACRO2010 43rd IUPAC World Polymer Congress
11 – 16 06 2010, Glasgow
http://www.rsc.org/ConferencesAndEvents/RSCConferences/Macro2010/

5th Inter. Symposium on Bioorganometallic Chemistry
5 - 9 06 2010, Bochum
http://www.rub.de/isbomc10

5th Heron Island Conference Reactive Intermediates and Unusual Molecules: Synthesis and Mechanism,
10-16 06 2010, Heron Island, Queensland
http://iccc2010.eventplanners.com.au/Portals/7/Heron_5Flyer3.pdf

39th International Conference on Coordination Chemistry
25 -30 06 2010, Adelaide
http://iccc2010.eventplanners.com.au/

14th International Symposium on Solubility Phenomena & Related Equilibrium Phenomena,
25-30 06 2010, Montanuniversität Leoben
http://issp.unileoben.ac.at/

21st International Conference on Chemical Thermodynamics
1 – 6 08 2010, Tsukuba
http://www.icct2010.org/