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CORPORATE FORESIGHT AT THE STRATEGIC RESEARCH INSTITUTES

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Abstract. Foresight – that is systematic, in-depth analyses of social, technological, economic, environmental and political development trends in order to anticipate their impact on organisation, sector or a region in a long term perspective – supports taking effective strategic and operational decisions at different organisational levels and thus shapes a country's economic development. The paper gives an overview of the corporate foresight process realised at the Institute for Sustainable Technologies – National Research Institute (Radom, Poland) based on an original technology foresight model, which takes into account the results from national and sectoral foresight processes in order to generate and prioritise future research priorities and technologies of the institute. The paper gives evidence of the practical implementation of the institute's corporate foresight scientific outcomes into the national R&D agenda through the launch of the strategic research programme "Innovative Systems of Technical Support for Sustainable Development of Economy".

Keywords: prioritizing R&D, foresight model, advanced technologies, research institute, strategic research programme.

JEL Classification: O32.

Introduction

The systematic analysis and monitoring of social, technological, political or environmental development trends is of crucial importance for optimizing a country's or an organisation's ability to anticipate future developments. It can also aid the construction of the most relevant national innovation policies and effective decision-making in business management.

Foresight is an important means for reaching these objectives (Martin 2010) as it is "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" (Coates 1985).

Foresight use is not limited to the publicly-funded national or regional programmes but it is also executed at the organizational (corporate) level, for example at the technologically advanced companies or research institutes. In the technologically advanced companies, the implementation of foresight help them improve their efficiency and build (or strengthen) their global competitiveness considering the turbulent environment in which they operate. Whereas, the institutes could use foresight to set priorities of strategic research, which correspond to national and international trends of S&T development, and most importantly: to set operational, business-oriented priority directions of development.

As there is a wide array of qualitative and quantitative research methods, which can be used equally and in parallel to arrive at the planned foresight results, the successful implementation of foresight processes, both at the macro, and micro levels depends, among others, on the applied methodology.

The paper concentrates on corporate foresight implemented by research institutes in order to anticipate their own development. Due to the following three reasons:

- The specific role of research institutes in national innovation systems (discussed further in the paper),

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- The sometimes contrasting R&D development perspectives, stemming from the varying expectations of their clients, that is: governmental and private organizations and
- The lack of a comprehensive theoretical foresight model dedicated to setting R&D priority research areas and directions by research institutes in the scientific literature on the subject
- the authors have decided to develop an original foresight model and a methodology dedicated to research institutes. The model pilot-scale verification was carried out at the Institute for Sustainable Technologies – National Research Institute (Radom, Poland).

1. Previous research

The analysis of foresight initiatives carried out in Europe indicates that the vast majority of projects regard national, regional or sectoral foresight (Popper *et al.* 2007; Future oriented... 2008). In the scientific literature on the subject, particular emphasis is placed on the dissemination of theoretical and practical aspects of these projects; whereas, information on the methodology of foresight implementation at the institutional level (corporate foresight) is limited.

With regard to foresight in business, distinctive examples mostly include multinational and transnational corporations (e.g. Shell, Daimler, Siemens, Philips, Nokia), which have pioneered in the setting up of special foresight units or teams within the company. They aimed to analyze changes that occur in their environments, namely: the macro environment (which include socio-cultural, technological, economic, ecological, political factors) and the micro environment (which encompasses consumers, suppliers, competitors, other stakeholders) in order to more effectively manage the components of their internal environment (mostly: employees, financial, technological and production base). Scholars who pursued research in the field of corporate foresight included among others: Heijden (1996), Reger (2001), Ruff (2004), Karp (2004); Duin (2006), Öner, Göl (2007), Vecchiato, Roveda (2010), Rohrbeck (2010).

A specific type of a corporate foresight is the foresight implemented in research institutes. A research institute is a legally, economically and organisationally distinguished organisational unit set up in order to carry out basic and applied research activities, the outcomes of which should be successfully transferred to the commercial sector for public benefit. The examples of such institutes include: TNO – the Netherlands Organisation for Applied Scientific Research (www.tno.nl), VTT Technical Research Centre of Finland (www.vtt.fi), Fraunhofer Society (www.fraunhofer.de), VITO Flemish Institute for Technological Research (www.vito.be). In Poland a group of research institutes is distinguished with the status of National Research Institutes. The vocation of such institutes is twofold: (1) the conducting of (state-funded) strategic research in the areas of priority importance for the sustainable development of a country, where convergence with national R&D priorities should be preserved and (2) the conducting of privately funded research with a view to develop and commercialize certain products, technologies or know-how. Therefore foresight projects executed by research institutes encompass the elements of national, sectoral and corporate approaches.

Research institutes are often partners in national, regional or sectoral foresight projects but seldom implement a corporate foresight process (Klinger *et al.* 2008; Olsmats 2002) in order to anticipate their own development. As the mission of such organisations differs significantly from the vocation of typical profit-oriented companies (they are more oriented towards the public benefit) the need was to develop a tailored- made foresight approach (Łabędzka 2011) built on the authors' experience in implementing foresight processes at national and sectoral levels, the outcomes of case studies analysis and literature review on the subject including the above mentioned authors and: Olsmats (2002); Medonca *et al.* (2004); Pirttimäki (2006); Hiltunen (2007); Könnölä (2007); Klinger *et al.* (2008).

The paper focuses on how the foresight approach was organized, which methods were employed, what outcomes were created and what lessons were learned.

2. Methods

Foresight process carried out at the Institute for Sustainable Technologies – National Research Institute in Radom, Poland (ITeE – PIB) was mainly focused on prioritizing longterm R&D for the institute. Table 1 presents the characteristics of the foresight process executed. The described

Table 1. The characteristics of corporate foresight executed at ITeE – PIB

Elements	Attributes	
Impact	– on the institution	– on the sector(s)
Objectives	– prioritizing longterm R&D for the institute – implementing the results of foresight process into the economy – enhancing internal collaboration (among the institute's researchers) – enhancing external collaboration (between the institute's researchers and other stakeholders)	

End of Table 1

Elements	Attributes	
Scope of research	Statutory R&D activities of the institute according to scientific disciplines:	
	– machine construction and maintenance, – mechatronics and electronics, – environmental engineering and protection of the environment,	– material engineering, – mechanics, – technical safety.
Time horizon	– longterm (10 years)	
Foresight model	– an original technology foresight model, which integrates the elements of the Collecting Post, Observatory and Think-tank modes described by Becker (2003)	
Foresight team	Internal experts: – expert panel including managers and researchers of the institute's R&D and non-R&D departments – foresight methodology team External experts: – representatives of cooperating entities: companies, other research institutes, government administration	
Foresight approach	– integration of the bottom-up and top-down approaches	
Main foresight stages	– pre-foresight (design of the foresight methodology) – foresight (execution of foresight) – post-foresight (implementation of foresight outcomes)	
Foresight methods	– benchmarking – key technologies – SWOT – STEEPV – structural analysis	– scenario building – technology roadmapping – workshops – expert panels – questionnaire survey
Outcomes	– the list of key R&D priorities in five research areas – the list and characteristics of key emerging and incremental technologies – the strengths, weaknessess, opportunities and threats of the institute – 3 alternative scenarios of the institute's R&D activity development – the strategic research programme, that would allow for the implementation of the preferred scenario	
Beneficiaries	– research teams of R&D departments of the institute, managing directors, – cooperating institutions, ministry of economy (the Institute's supervising entity)	

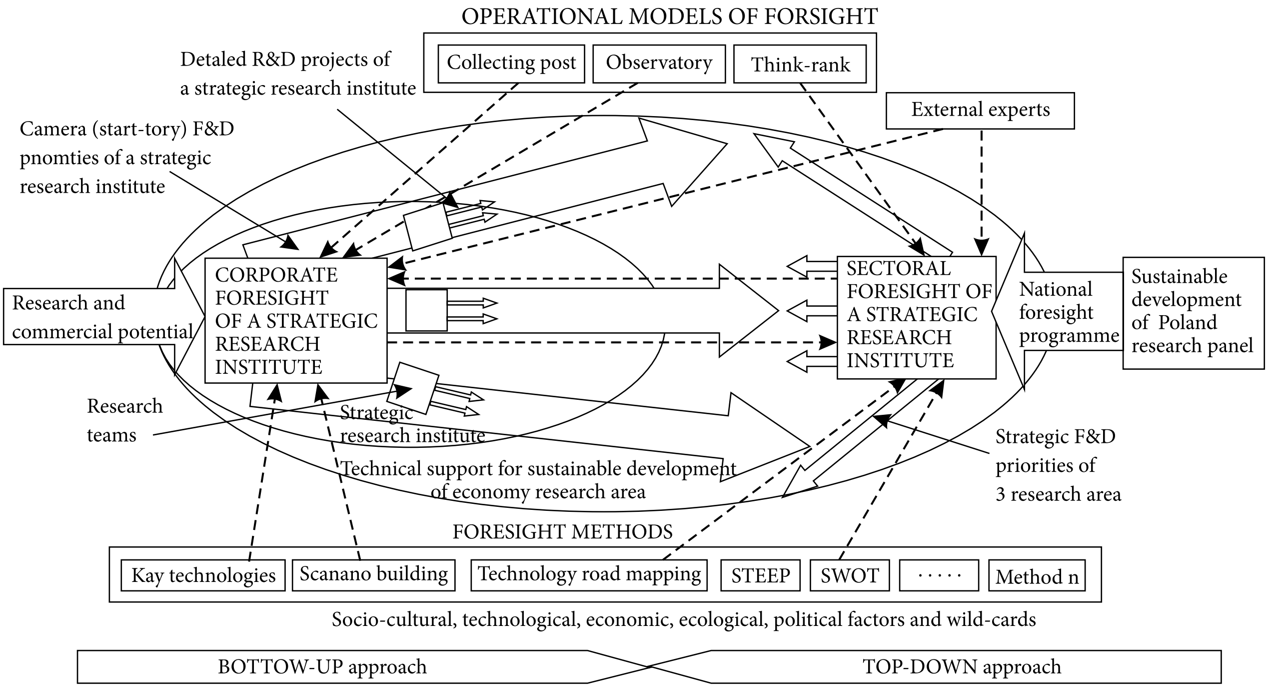

Fig. 1. Technology Foresight Model (TFM)

elements include: impact, objectives, scope of research, time horizon, foresight team, foresight model, foresight stages and methods, outcomes, beneficiaries, realisation period, sources of financing.

The elements of the executed foresight process and the links between them are shown in Figure 1.

The model assumes that R&D priorities of a research institute are determined on the basis of the results obtained in a foresight process, which integrates an organisational, sectoral and national perspective. The elements of the model can be replaced, updated or supplemented (i.e. regarding foresight methods, which better address the needs of a specific foresight project objectives).

In the developed model it was assumed that the confrontation of the development directions for a scientific institution that are generated with the use of a corporate foresight, with the directions generated in the national and sectoral foresight project, is of greatest importance. The model implies the comparison whether the priorities selected on the national or sectoral scale correspond to those proposed by the research institute, and whether the institute is in the possession of, or capable of achieving a sufficient substantial, infrastructural or personnel potential needed for the realization of generated research directions and advanced technologies expected to be developed.

The model presents the algorithm of generating, with the use of foresight methods, the detailed and strategic research directions for particular thematic areas. It was assumed that the subject area of research projects carried out by particular organisational units (or research teams) of the strategic R&D institute constituted a factual base for determining leading research directions for the whole institute. The model also covers the identification of integrated groups of leading research directions on a national and world scale on the basis of strategic research directions generated for particular identified thematic areas in national foresight programmes (a top-down approach).

The integrated groups of directions on the national level on the one hand, and the detailed research directions of the institute (a bottom-up approach) on the other hand, also make a basis for indicating leading research directions of sectoral investigations, carried out within the sectoral foresight project.

Along with the model, an operational methodology of the foresight process was developed and verified (Fig. 2).

Firstly, the objectives of the foresight process were set. These included:

– prioritizing longterm R&D for the institute,
– implementing the results of foresight process into the economy,
– enhancing internal collaboration (among the institute's researchers),
– enhancing external collaboration (between the institute's researchers and other stakeholders).

The time horizon of the process was adopted from the National Foresight Programme "Poland 2020", the results of which were the starting point for the analyses executed in the framework of the institute's corporate foresight process according to a top-down approach.

The methods, which were the most suitable in reaching the agreed objectives of the foresight process included:

– benchmarking, key technologies – in order to determine the Institute's R&D priorities,
– SWOT, STEEP, structural analysis – in order to define key factors, which influence the R&D activity of the institute,
– scenario building – in order to create alternative visions of the Institute's R&D activity,
– technology roadmapping – in order to elaborate an operational plan for the implementation of the preferred scenario,
– expert panels, workshops, questionnaire surveys and brainstorming – in order to support the implementation of the primary, above mentioned methods.

Both internal experts (mostly scholars) representing ITeE-PIB and external experts representing science, industry and federal administration contributed to the foresight process. Working procedures of the expert groups were based on the three operational models: Collecting Post, Observatory and Think-tank (Becker 2002). Some of the foresight analyses were executed by internal experts independently in each R&D department of the institute with

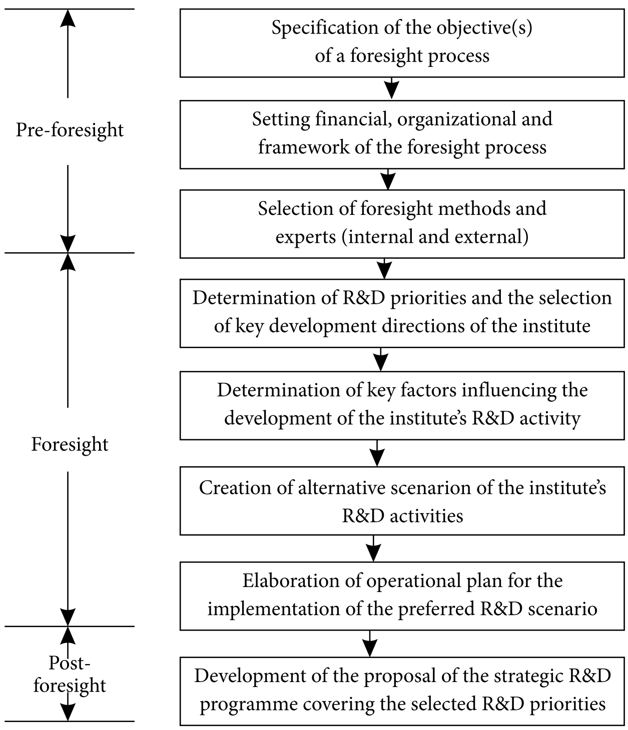

Fig. 2. Main stages of the foresight process executed at the Institute for Sustainable Technologies – National Research Institute

the use of relatively simple foresight methods: state-of- the art analysis, benchmarking, brainstorming, questionnaire surveys (features of the Collecting Post model). The main part of foresight research was carried out during expert panels by means of more sophisticated techniques such as: scenario building, technology roadmapping (features of the Observatory model). Whereas the key analyses included the determination of critical R&D priorities set with the use of key technologies method during a series of expert panels with a serious contribution from external experts representing various institutions and country regions (features of the Think-tank model).

Foresight process began with the setting of priority research directions and technologies of the Institute for Sustainable Technologies – National Research Institute (ITeE – PIB). The research was executed in five thematic areas of strategic importance for the sustainable development of the economy:

- Specialised research and test apparatus;
- Mechatronic technologies and control systems for the support of manufacturing and maintenance processes;
- Advanced material technologies and nanotechnologies and technical systems supporting their design and application;
- Environmental technologies, rationalisation of the use of raw materials, resources, and renewable energy sources;
- Technologies of technical and environmental safety

Priority research directions and technologies covering the general, statutory field of the institute's activity (that is: innovative systems of technical support for sustainable development of economy) were identified according to the methodical procedure shown in Figure 3.

At the first stage the analysis of research projects carried out at the institute and cooperating organizations was executed (I), with the greatest attention paid to programmes with a national level of influence. Based on the analysis of several hundreds of projects carried out within the framework of the strategic Polish government programmes, international programmes, and activities executed directly for economic units and administrative bodies, the lists of scientific tasks for particular thematic areas were drawn (II). They formed the basis for the formulation of the initial list of general priority research directions that were possible to be realised at the institute because of its present intellectual and infrastructural potential. The analysis of the cohesion of determined research directions realised at the institute with research directions in a given thematic area carried out by sectoral, national and international organisations were the next step of the works conducted. For this reason, the analysis of the state-of-art was carried out. The analysis of the state of knowledge conducted helped in the selection of the priority research directions that had not been taken into consideration before, and in the elimination of the proposals of little perspective, which in turn made the verification and modification of the priority research directions possible. On the basis of the confrontation of generated directions of the research realised at the institute with the directions of priority research conducted on the national level, the final list of general priority research directions for each sector and the country, in which works realised by the institute are encompassed, have been identified (III). The next stage of the works was the identification of integrated leading research directions coherent with global trends. The research on global development tendencies in selected areas of strategic importance was conducted and system mechanisms for the implementation of innovation and generation of new

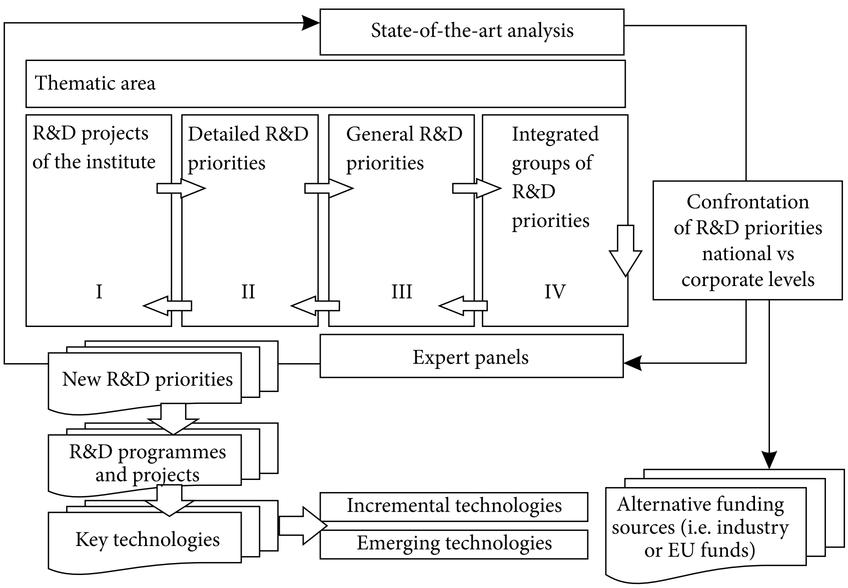

Fig. 3. Methodological procedure for the identification of the institute's future priority R&D directions and technologies

research works in the domain of selected problematic area were proposed and applied. Conducted analysis indicated that the key directions of research works realised at ITeE-PIB in the priority area of technical support for sustainable development correspond to the highest standards of national and international research works. On that basis integrated groups of research directions were formed in the above stated area (IV).

At the time of the identification of integrated groups of research directions, their coherence with priorities generated in "Poland 2020" National Foresight Programme" (MNiSW 2009) was considered. The outcome of the analysis showed that the integrated groups of research directions fully agreed with those indicated in the National Foresight Programme "Poland 2020" in the research panel "Sustainable Development of Poland". They also corresponded to the subject of selected Polish sectoral foresight projects, including those concerning new materials and technologies.

Selected research directions were the basis for the generation of future product and process technologies by the internal experts of the institute (62) and the representatives of external entities (106) with the use of two methods: expert panels and questionnaire surveys. A special attention was paid to the issue of including young scientists and the representatives of technological platforms in the process, along the recognised and respected scientists. Altogether, 74 technologies were generated by internal experts in co-operation with external authorities in the framework of the five aforementioned research areas under consideration. The technologies were classified into two groups: incremental and emerging technologies. Incremental technologies are understood to be the technologies directed at a gradual improvement introduced to already existing solutions through a systematic implementation of innovative products based on new knowledge. Incremental research are thus based on the improvement of existing methods and the development of innovative solutions ready to be implemented and important from point of view of an individual business or the entire industry sector. Emerging technologies, on the other hand, are considered to be absolutely innovative technical solutions characterised by a sudden development in a given area of knowledge and practice and facilitating the achievement of a high competitive rank (Soares *et al.* 1997). Incremental technologies are considered in the time horizon of 3–5 years, whereas emerging technologies are situated in the time horizon exceeding 10 years.

The next stage involved preparing detailed characteristics of the selected 74 priority product and process technologies. Within the characteristics developed it has been stated whether the technology is already functioning on the market, is ready to be commercialized, is presently subject to testing or will only emerge in the future. The information on the sectors in which the technology is or will be applied has been given, as well as what the development prognosis for 2020 and the potential ecological, economic and social effects will be. The information on each technology was used in the final prioritisation procedure, in which the following criteria were considered:

- Sustainable development (including subcriteria of ecological, financial and social effects);
- Generic criterion (taking into account the interdisciplinarity level of technological solutions).

Both criteria were considered to be of equal importance, each represented numerically by the total amount of 50 points possible, however in the case of sustainable development criterion, the points could have been represented by negative values indicating negative economic impact of the ecological, financial and social effects of practical implementation of incremental and emerging technologies. After completion of the prioritisation procedure 4 to 5 critical technologies were selected in each research area. They were the subject of further analyses executed on the later stage of foresight process with the use of roadmapping.

Determination of key factors influencing the development of the institute's R&D activity was the next stage of the institute's foresight process. Key factors were selected with the use of quantitative and expert methods. The overall number of scientific and technical personnel involved in the research amounted to 70. The procedure for the selection of key factor included the following phases:

- Identification of strengths, weaknessess, opportunities and threats of the institute (SWOT),
- Generation of the initial list of influencing factors based on the outcomes of the SWOT analysis and their classification according to STEEP approach,
- Extension of the initial list of influencing factors based on the outcomes of the questionnaire survey among the internal experts (scientific and technical personnel of the institute),
- Evaluation of the extended list of influencing factors by internal experts,
- Generation of the most influencing factors (11) based on the outcomes of the internal evaluation,
- Evaluation of the relations occurring among the most influencing factors (structural analysis with the use of the matrix of direct influences),
- Generation of four key influencing factors with the use of MicMac software (available at http://www.prospectiva.eu/curso-prospectiva/programas_prospectiva),
- Generation of the two key influencing factors (expert panel).

As a result of the conducted analyses the two key influencing factors identified included: scientific and research potential and financial standing.

The next stage of a model verification at ITeE-PIB was composed of scenario building based on the two key influencing factors and generated research directions determining the suggested scope of research. For that purpose, the technique of scenario axis (Klooster, Asselt 2006) was applied. The two aforementioned key factors were projected onto the Cartesian coordinates plane, where the beginning of the axis represented the lowest value of the factor, and the end – the highest. The four possible variants of the values of the pair of factors formed the framework for the creation of scenarios: A, B, C and D (Fig. 4).

Further analyses were focused on A, B and C scenarios only, which assumed the development of the Institute (quicker or slower, but still development).

The general assumptions of scenarios under analysis included:

– Scenario A – „Basic Research"

Strong focus on the development of basic research and weaker, but still crucial, participation in development research based on high R&D and personnel potential at the time of bad financial situation of the Institute were assumed in this scenario.

– Scenario B – "Sustainable development"

In this scenario a dynamic and uniform development of scientific, development and application research based on high R&D and financial potential were the focus point.

– Scenario C – "Market"

This scenario assumes that realised research would concentrate on development and implementation research in selected technologically advanced domains based on flourishing financial situation at the time of unsatisfactory level of R&D potential.

The structure of the scenarios included two main elements: the characteristics of social, organisational, scientific, technological and financial trends of the research institute shaped by the influence of both positive and negative development tendencies of the identified key factors; and the description of strategic R&D activity indicating priority research directions, technology groups and generated key technologies that have greatest development opportunities within a given scenario.

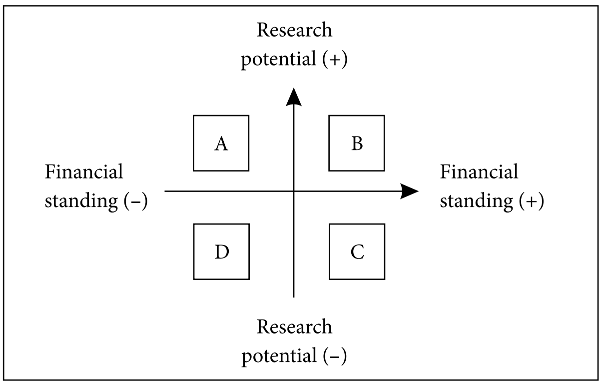

Fig. 4. ITeE-PIB's scenario frameworks

The final phase of the foresight process involved the elaboration of operational plan for the implementation of the preferred R&D scenario with the use of technology roadmapping method (Phaal, Muller 2009). The plan in the form of a technology roadmap was developed during workshops by a group of internal experts supervised by the institute's foresight methodology team. Experts designed the roadmap that encompassed three layers, that is: "Market requirements", which consisted of political, economical, social, environmental, technological factors determining the development of the materials, technologies, devices, systems listed in the "Product" layer and "Resources" layer, which indicated the human, technological and financial potential necessary to develop and launch the aforementioned products into the market. The layer "Market requirements" was developed with the use of STEEP approach; the layer "Product" was prepared on the basis of information available from the detailed characteristics of key incremental and emerging technologies set and described during the initial stage of the foresight process; the layer "Resources" was elaborated on the ground of the results of the SWOT analysis of the institute. Finally, the recommendations were formulated on what actions should be taken in the present to reach the preferred future scenario.

The crucial recommendation concerned the need to apply for national or EU funding in order to implement the scientific outcomes of the institute's foresight process.

3. Results, discussion and limitations

The most important outcome of the institute's foresight process was the development of the proposal and the launch of the strategic R&D programme covering the R&D priorities selected in the institute's foresight process.

The programme entitled "Innovative Systems of Technical Support for Sustainable Development of Economy" won the competition and is being jointly realised by the ITeE-PIB and Polish R&D institutions and enterprises within the Innovative Economy Operational Programme (co-financed from the EU structural funds) in the 2010–2015 period.

The aim of the programme is to develop, on the basis of programmed research results, the advanced product and process solutions ready to be practically implemented in the field of production and maintenance of technical objects. The realisation of the tasks will enable the innovative technological, operational and organizational solutions to be obtained and will also facilitate the increase in the scope of application of the research works results in economy, and, moreover, will help the national enterprises rank higher on competitiveness.

An effective execution of the Strategic Programme requires close interactions and connections between its research tasks aimed at the development of innovative technologies and the system support in the area of knowledge transformation and technology transfer, as well as activities for the organisational support in the form of organisational and informational platforms aiming at the development and dissemination of innovative solutions (Fig. 5).

Tasks in the area of improving the efficiency of knowledge transformation and technology transfer processes undertaken within the Strategic Programme include among others the determination of future research directions.

Determination of research directions of the future and priority technologies to be developed by research institutions and their updating and monitoring is of crucial importance to the functioning of such institutions. Tasks incorporated in the Strategic Programme are focused on the key aspects of future R&D directions identification, including the issues of generating key factors determining the way the research is conducted, rating of technologies with view of their innovativeness and competitiveness as well as issues concerning scenario probability determination. Execution of these processes is supported by the developed computer system FORStech.

Conclusions

Foresight objectives

The objectives of the institute's foresight process (as outlined in Table 1) were met. First of all, priority research directions in five research areas were generated. Secondly, the design of the foresight process (mainly the application of methods implemented through workshops and expert panels) triggered interdisciplinary cooperation among the research personnel of the institute's various departments and led to collective action, which resulted (among others) in the elaboration of scenarios and operational plans for the realisation of the most preferred vision of the future. Thirdly, the active involvement of external stakeholders in the institute's foresight process raised their interest for common research and development projects.

All of the above resulted in the joint effort undertaken in order to develop and launch a strategic R&D programme: "Innovative Systems of Technical Support for Sustainable Development of Economy" based on the R&D priorities set in the foresight process. The research tasks performed within the programme are coordinated by the institute and executed in the cooperation with its industrial and academic partners.

Foresight methods

The novel design of the foresight process, which integrated national, sectoral and corporate perspectives appeared to be efficient in spite of the rather traditional foresight methods used. A formally organised, collective methodological approach was in line with the organisational culture of the institute as opposed to less structured foresight analyses implemented in e.g. ICT multinationals along such methods as environmental scanning (Abraham, Hines 2007). Nevertheless, an update of the list of methods used in the institute's foresight process and the modification of some of the applied techniques is needed and is done within the currently executed Strategic Programme.

As foresight analyses are to be conducted on a regular basis in the institute, some methodological improvements have already been introduced. As foresight is to be used on a regular basis at the institute, two methodological

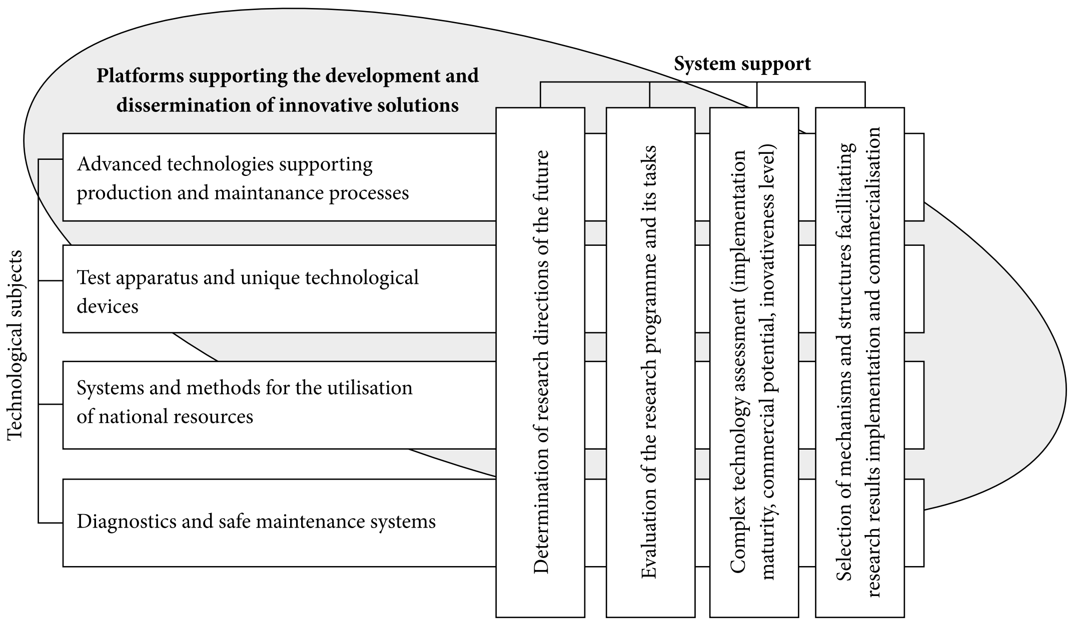

Fig. 5. Correlation of research tasks of technological nature with activities providing system support in the area of knowledge transformation and technology transfer and organisational support

improvements have already been introduced. The first one relates to the introduction of the additional quantitative methods into scenario-axes approach, which is most often implemented via qualitative expert-based methods such as workshops (Klooster, Asselt 2006). The improved scenario-building methodology encompasses a quantitative algorithm, which enables the precise identification of key driving forces of highest influence and importance. By overcoming subjectivity, which is the main disadvantage of expert-based methods, the proposed methodology ensures/guarantees reliable and repeatable results. Also, the updated scenario-building methodology allows for the inclusion of more than the two key influencing factors around which scenarios are built through the "traditional" scenario-axes technique-based approach. Further analyses are being conducted in order to be able to assign the degree of probability to the scenarios.

Following Popper (2008), who claimed to "consider less frequently used foresight methods" authors introduced the second modification of the foresight methodology. In the foresight project, the strengths and weaknesses of the institute were captured by the Intelectual Capital measurement methods instead of the widely applied SWOT. IC measurement methods are commonly used in the context of corporate business management (Sveiby 1997; Sullivan 2000) and increasingly by universities (Leitner 2002; FH Joanneum IC Report 2010–2011). Whereas, the method does not appear in the comprehensive list of foresight techniques presented by Popper (2008) and Magruk (2011). Additionally, the authors of the paper have found only one example of the use of IC methods by a strategic research institute in order to prepare its IC Report: the Austrian Institute of Technology (Leitner, Warden 2004), but this activity was not connected to foresight. The authors are of the opinion that measuring IC of a research institute would help (1) better assess the institute's strengths and weaknesses by estimating the real value of the institute's IC assets, and (2) better control their improvement with a view to effectively implement foresight results.

Foresight actors

Apart from methods, the involvement of foresight actors should be underlined. Even though the number of external participants who contributed to the institute's foresight analyses surpassed the number of internal experts, their role in the foresight process should be strengthened. External experts were engaged mostly in the first phase of the research, that is the setting of R&D priorities, whereas their participation in the scenario building was limited to the stage of selecting key influencing factors and roadmapping phase was realized exclusively by internal research personnel of the institute.

Equally important is the affiliation of external experts. In case of the institute, which depends both on public and private financing, the representatives of innovative SMEs as well as relevant ministerial departments in foresight activities is inevitable. This should ensure that the selected R&D priorities are in line with national innovation and development strategies and meet the needs of the economy.

In order to ensure appropriate conditions for further R&D cooperation, to increase the effectiveness of the technology transfer process, as well as to keep the stakeholders informed on the institute's R&D agenda – a model platform for the popularisation of innovative technological solutions created within the Strategic Programme "Innovative Systems of Technical Support for Sustainable Development of Economy" is set up.

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Disclosure statement

Authors declare they do not have any competing financial, professional, or personal interests from other parties.

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