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CONCEPTUAL FRAMEWORK FOR FORESIGHT DEVELOPMENT

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Abstract. The article summarizes the current trends in the foresight development and investigates the methodology evolution, examples of good practice and future developments. The initial research idea was based on the methodological issues for e-government system implementation in Lithuania [5]. In order to model the future of e-public services, it is necessary to assess the scope of the factors influencing the system and decision-making, their importance and the level of technology. The article presents the results of the hierarchical cluster analysis used for expert group assessment in Lithuania.

JEL B41, C8, C23, C31, C33, C52, I31.
Keywords: Foresight, methodology, Delphy, e-government, good practice, generation.
Reikšminiai žodžiai: įžvalgos, metodologija, Delphy, e. valdžia, gera patirtis, karta.

I. Introduction

The process of globalization has a multidimensional interpretation. During the recent three or four decades the real world has dramatically changed. Science and technology achievements created new forms of research cooperation. The access to information led to socio-economic development. Close attention is paid to the foresight methodology development as an essential support for policy and strategy making at a supranational level. At the same time, globalization generates new problems which require new integrated policy responses. The advanced countries that have successfully raised incomes have visions for the future and are active participants in the world strategy development. At the same time, the globalization process influences the poverty in many countries. Global megatrends and national challenges create the contexts and backgrounds for taking strategic decisions. Transnational foresight exercises that can be considered as the first stage of foresight cooperation are the cases where transnational collaboration mainly focuses on foresight competence and network building (FORETECH, eFORESEE, Millennium Project 2050).

Due to a limited number of economic contexts and difficulties in comparing different methodological approaches, it is necessary to carry out an in-depth research into the aspects and importance of regional innovation, the importance of mutual interaction in multi-actor arenas of innovation policy, the impacts of multi-level governance, and the side-effects of non-regional policies in the context of global socio-economic trends. It is essential to enlarge the empirical basis of knowledge-based regional development strategy-making in order to make it possible to draw on as many different case studies as possible. Foresight activities and vision-building are important for understanding the mechanisms of multi-actor and multi-level regional governance, regional innovation, and for creating knowledge-based clusters. Experts from the Science and Technology Foresight Center and the National Institute of Science and Technology Policy (NISTEP, Japan) developed the methodology of foresight surveying for two countries, Japan and Finland, with recommendations for policy-makers.

The barriers to and the opportunities for transnational foresight are directly linked to the selected focus area of technological domains, i.e. a particular sector, horizontal public functions or the whole national innovation system. The focus determines the perimeter to which the results will apply as well as the stakeholders to be involved. NISTEP has 30 years of experience in technology foresight; it has already conducted the 8th technology foresight survey in Japan in 2003–2004. The evolution of foresight methodology [j)] shows the theory development and improved policy making strategies. Four foresight scenarios were developed in the advanced studies. As a part of global foresight trends, e-government system introduced in Lithuania was used to develop a foresight methodology relevant for assessment. Due to a lack of developed foresight strategies in Lithuania, the investigation of digital public services is carried out by using integrated methods.

1. Foresight Levels

There are a number of sources in which the dimension of the levels [15, 21] (from the simple units to inter-dimensional, complex dynamic and socialized systems) is presented. The ambitious systems are defined as the sources of regional competition generation in the changing environment. Future research could provide the regional foresight tools. The European Foresight Monitoring Network (EFMN, created in 2004 under EU support) has promoted the cooperation and networking in science, technology and innovation (STI) in 2004-2007. In this period, over 1600 examples of foresight exercises were collected from all over the world. The data contained 1650 initiatives. The following levels of foresight initiatives are distinguished: national (covering one country), supranational (covering clusters of countries), and transborder (international by nature and not focusing on specific countries).

Table 1. The shares of foresight exercises from the EU27+ (2004-2007), %

National	Sub-national	Transborder	Supra na-tional	Europe
67	15	8	7	3

Source:[19]

EU27+ group includes 557 cases. Some 545 from the 27 European Union Member States (Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom) plus 12 cases from Iceland, Norway and Switzerland [19].

National Foresight

Foresight at the national level has been used to address choices within the domain of STI as well as the impacts of science and innovation on the economy and society. At this level the focus is on the experience gained from the national Foresight exercises and new research methodologies. The time horizon used ranges from 15 till 50 years. To foresee the direction of future science and technology development during the period of 2000–2020, NISTEP used integrated methods. The foresight exercises had been collected through three rounds of strategic conferences. The attitudes of 2677 people including well-qualified personnel and experts from the public sector, private sector and disparate group of people were studied. Each conference aimed at eliciting expert opinions on the direction of future science and technology deemed to be of high importance for economic and social development of the country. The aim of the strategic conferences is also to build a network of industry-government collaboration which would enable an understanding of the changes occurring in business and an evaluation of research priorities. As a result of these studies, socio-economic visions were developed as well as recommendations for successful policy implementation were suggested. A conceptual illustration of Health and Lifestyle in Japan is presented in Picture 1.

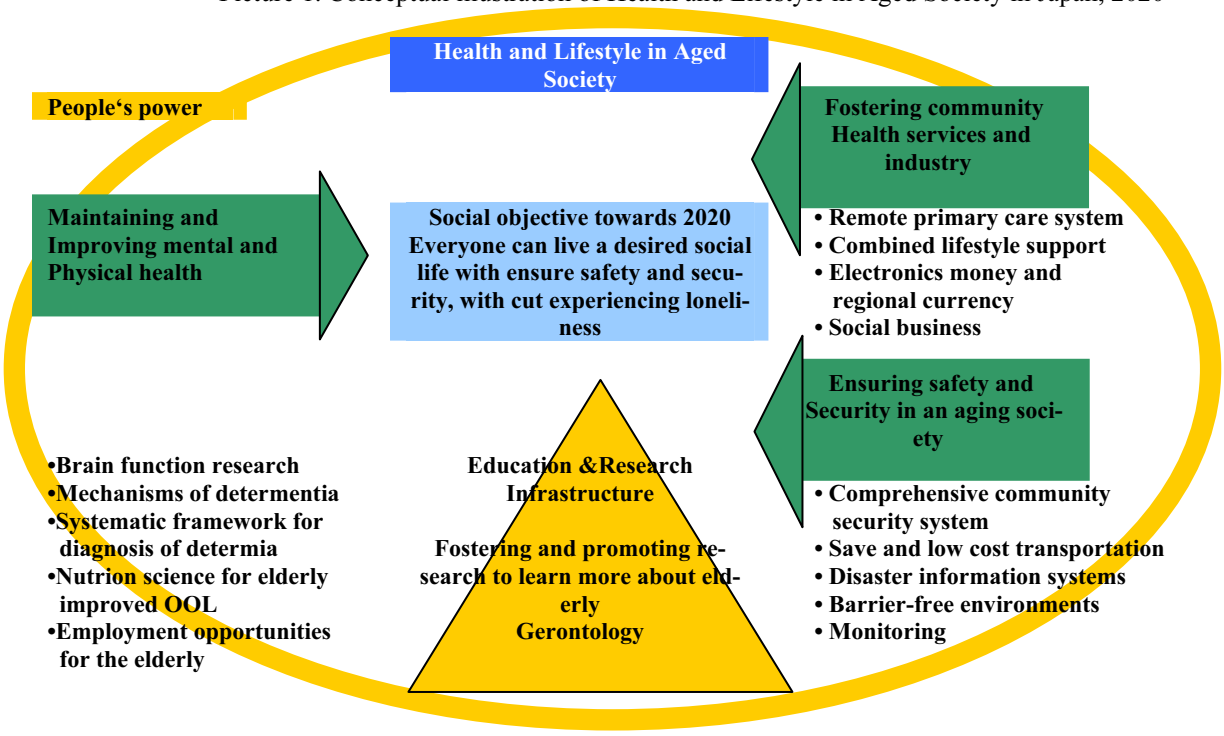
Regional Foresight

Both supra-national foresight, covering more than one country, and sub-national foresight, covering a smaller region of a country or neighbour regions of multiple countries, are considered.

Supra-national foresight has been useful to promote joint analysis of common problems, detect opportunities for cooperation, identify complementary attributes, and define infrastructures needed, which are not feasible at the national level.

Sub-national foresight is the application of foresight methods, which involve (involving some combination of five essential elements — anticipation, participation, networking, vision, action) to inform and orient decisions that are taken at the sub-national level.

Picture 1. Conceptual illustration of Health and Lifestyle in Aged Society in Japan, 2020



Sources: [10]

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Transnational Foresight

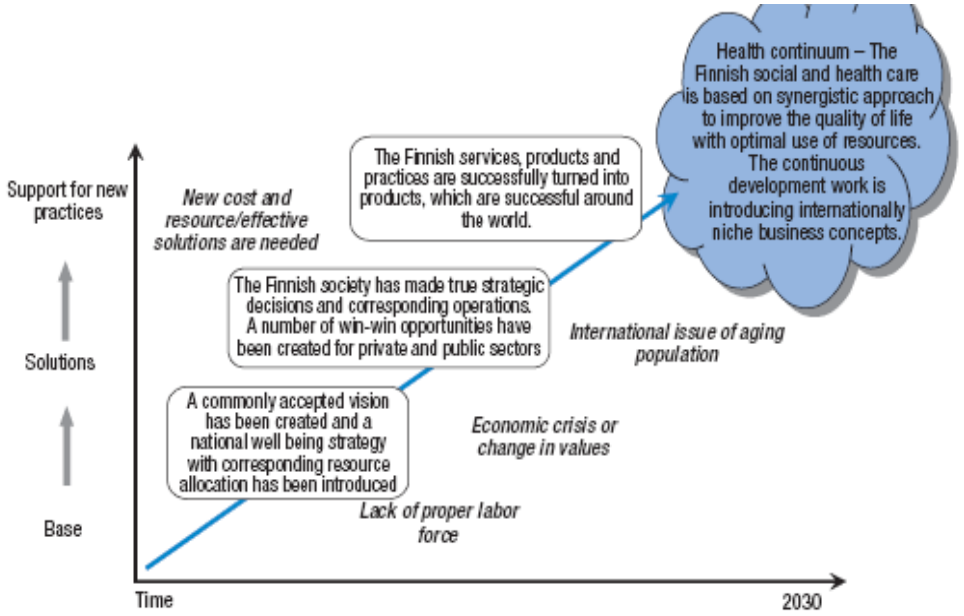
In this level national foresight activities are coordinated to implement efficient transnational programmes. The foresight programmes remain national and aim at valorising opportunities for exchanges in the different phases when it is deemed necessary and possible (exploiting "soft benefits") [3]. Each participant involved in the research consortium may have different motivations, aims and anticipated impacts.

The "hard" opportunities of transnational foresight are related to the sharing of the resources that are necessary to conduct a foresight exercise: gathering human resources, achieving economies of scale, and reaching critical mass are common benefits of international cooperation. The "soft" benefits are related to a particular field of foresight with the input of a wider range of opinions and expertise on the international context. The highest benefits appear in the "soft" items like sharing of information, improvement and setting of common foresight methodology, raising awareness, network effects, and reinforcing a common vision. Regarding the barriers to transnational cooperation, the survey revealed differences between countries, while at the same time overlapping results emerged. The barriers and opportunities to transnational foresight are directly linked to the variable "focus", such as a technological domain, a sector, horizontal public functions or a whole national innovation system. The focus determines the perimeter to which the results will apply as well as the stakeholders to be involved. Those foresight exercises with a focus on key technologies and sectoral innovation dynamics seem to be the easiest to implement in an international cooperation context. In contrast, trans-national cooperation in foresight will certainly be more difficult to apply in exercises that mainly aim to create national strategies like those related to innovation system efficiency or shared system strategies (Mauguen, 2007). The same report concluded that national priorities seemed to be the most prevalent barriers to cooperation in foresight. For instance, foresight exercises oriented towards priority setting are expected to confront severe barri-

ers, since national boundaries related to policy decision-making will be prevalent. Thus, the report concluded that foresight cooperation is dependent on the coordination of research and innovation public policies. The added value of transnational foresight will depend directly on the link to the policy it is supposed to inform. Therefore, the added value of the transnational foresight will be higher in the case where the policy is carried out at an international scale, or at least includes an important international component. Neither methodologies nor costs are perceived as major challenges. The real issues are related to the links to policy-making and to the participation of stakeholders in the foresight exercises. Nevertheless, the report concluded that it is interesting to see that to a certain extent transnational cooperation could be seen as a way to overcome these challenges (Mauguen, 2007). International research co-operation provides the broader geographic scope, resource concentration and cost efficiency.

An example of the transnational foresight is the study "Foresight for Our Future Society", NISTEP and Tekes, 2007. From the methodological viewpoint, the study was innovative, as the key objective of the joint foresight project between Finland and Japan (Tekes and NISTEP) was to combine Delphi survey, an expert panel process and other foresight methods [10]. Another example could be ForSociety ERA-NET (Mauguen, 2007), in which anticipated benefits are grouped as "hard" and "soft" [3].

Picture 2. Conceptual illustration of Health and Lifestyle in Aged Society in Finland, 2050



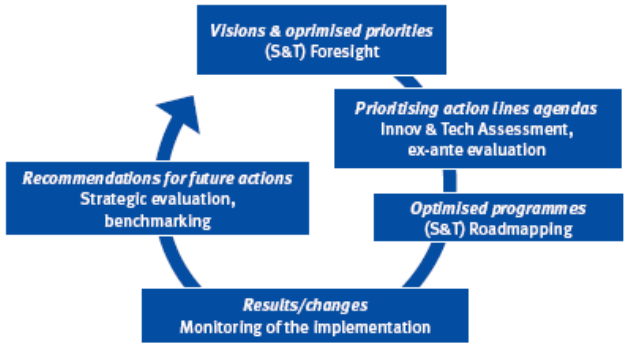
Source: [10]

The policy recommendations supported by concept and foresight results cover the tight relationship between the operations to support a healthy life style and the costs of institutional health care, businesses, research and development and innovation, etc. Other conceptual visions and policy recommendations were developed for industries and media sectors, to make steps on the path "towards the realization of a recycling society through the recycling and re-utilization of resources, i.e. atmospheric purification, the reduction of gas emissions contributing to global warming, the creation of new energy sources and the efficient use and reuse of resources, sustainable use of water" [10].

Sectoral and Corporate Foresight

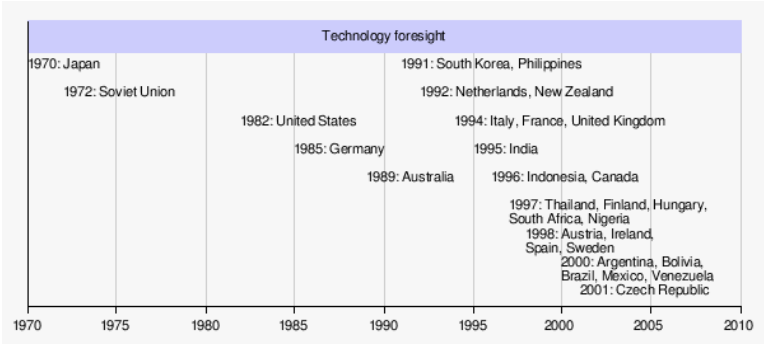
The challenges faced by firms reflect the structural changes taking place in the economy and society. A new global setting of the world economy is defining the framework for operation of the industrial sector both within the national boundaries and internationally. In this context, the corporate sector and industries use foresight to detect and prepare responses to such changes. The experience gained at the corporate and sectoral level, and main research and methodological issues are of utmost importance.

Picture 3. The common science and technology foresight track



Source: [22]

Picture 4. International cases of foresight collaboration



International cases of foresight grow rapidly with support of EU funds. Today there are more than 2000 cases within the EFMN. In the terms of targets, the international foresight exercises have not presented any differences comparing with the European ones. The majority of the exercises have targeted the government agencies and departments, the research community and firms.

Regarding the barriers to transnational cooperation, the survey revealed differences between countries, while at the same time overlapping results emerged. The barriers and opportunities to transnational foresight are directly linked to the variable "focus", such as a technological domain, a sector, horizontal public functions or a whole national innovation system. The focus determines the perimeter to which the results will apply as well as the stakeholders to be involved. The foresight exercises with a focus on key technologies and sectoral innovation dynamics seem to be the easiest to implement in the international cooperation context. Transnational cooperation in foresight will change the communication technology and social world-class research infrastructures, integrated, networked and accessible to research teams from across Europe and the world. It is important to form research and innovation "clusters", which include "virtual research communities" that are mostly specialised in interdisciplinary areas and attract a critical mass of human and financial resources aiming at sharing knowledge effectively. The essential Foresight research limitation is a weak interrelation with the decision-making process as well as slight changes in understanding foresight methodologies.

2. Foresight Methodological Principles

Since 1930 the forecasting has created methods and tools for the world's future design. However, these methods were recognized and taken into account only after the Second World War. The evolution of terminology from the "forecast" and "future study" towards the currently used "foresight" emerged and was supported by UNIDO, the EU and actively promoted by ERC. What regards foresight methods, the methodological justification is still insufficient and there is a lack of methodological research. The following foresight methods are used: scenario analysis, i.e. descriptions of possible future situation in order to anticipate and prepare for upcoming developments and policy decisions; Delphi methods for collecting and analyzing of expert and non-expert opinion on specific issues; computer simulations for the representation of possible future situations through computer modelling in order to investigate how present developments might turn out in the future; Future-Oriented Tech-

nology Analysis: the analysis of science and technology and innovation application and its impact on policy-making.[11, 14]

There is a growing international network of organizations and contributions, such as The Association of Professional Futurists, the World Futures Studies Federation, the European Foresight Monitoring Network, the OECD Future Group and others.

In Lithuania foresight activities have not yet been appropriately incorporated in strategic planning. However, the first steps towards promoting foresight methodology have been made. Since 2002, there have also been private initiatives: the Open Society Fund-Lithuania (Soros Foundation) organized the study "Lithuanian Future Scenarios: 2010-2020 Year"; in 2007, a study "Foresight for the Lithuanian Economy in the Light of Regional and Tendencies" was conducted by the Social and Economic Development Center.

3. Foresight Good Practice

There is great diversity in foresight methodology. In the examples of NISTEP the Delphi method is employed for a long-term strategy making; this shows the evolution of methodology. Foresight methodology has been improved several times in Germany. The overall process consists of several key steps:

- trend setting;
- trend consideration (panel discussion);
- future script development;
- implementation.

Since the EU adopted the Lisbon Strategy in 2000, the objectives of the EU as the most competitive and dynamic knowledge-based economy were defined, extreme attention was paid to the research and development of innovations. An important step of the European Commission was to propose a concept of European Research Area (ERA conception). One of the main objectives of this initiative is to bring together science, technology and social visions for the future. In 2002 the report "Thinking, debating and Shaping the Future: Foresight for Europe" was discussed by experts and the common opinion about the future input into the scientific activities to improve the strategic planning and policy development was expressed. At the same time, this foresight procedure was stated as a scientific methodology for innovations in education, for management improvement and policy flexibility. The methodology aimed at defining three key insight areas: (i)Thinking about future; (ii) Discussing about future, (iii) Creating the future. There are common methods used for foresight exercises. Table 2 shows the main groups and features of the methods used for foresight exercises.

Table 2. Comparison of quantitative and qualitative methods

Groups	Methods & tools	Advantages	Disadvantages
Quantitative Methods The future predictions based on mathematical and statistical data treatment.	• Extrapolation of time series • Probabilistic forecasting • Stochastic processes analysis • Regression analysis • Econometric models • Simulation modelling • System dynamics • Cross-impact analysis • Cost-benefit analysis • Input – output analysis • Game theory	• Information can be handled in consistent and reproducible ways, combining figures and comparing data. • Changes in scale and ratio can be examined. • Data is organised systematically to produce trend extrapolations and other forecasts. • Results are displayed in the form of tables, graphs and charts, which facilitate communication.	• Scarcely consider social and political variables. • Some phenomena are difficult to quantify. • Not everyone can work comfortably with statistical information. • Good quality data are often not available, or not sufficiently up-dated. • Some methods are highly complex and difficult to use.
Qualitative Methods The future predictions are based on intuitions and opinions of experts who posses reliable information and expertise about a specific issue.	• Opinion surveys • Experts interviews • Focus groups /• Expert panels • Delphi method • Scenario design • Iterative synopsis • Relevance trees • Morphological analysis • Catastrophe theory • Historical analogy • Incasting and Backcasting • Visioning	• Complex and uncertain situations can be tackled. • Stimulate creative thinking, supported by experts. • Do not require quantitative indicators.	• Cannot quantify future situations precisely. • Generate excessively speculative future visions. • The quality of the analysis depends on the expert's wisdom. • Not useful for anticipating short-term actions.
Complementary Tools	• Environmental scanning • Brainstorming • Mind mapping • Benchmarking • Critical technologies • SWOT analysis		

Table 3 shows a chronology of national and regional foresight activities, which are classified into those based mainly on Delphi and those based on other approaches, such as panels, scenarios or critical technologies exercises. In the third group several methods are combined.

This separation allows some of the international learning experiences to be traced. The best-known example is that of the "family tree" of Delphi surveys originating with the Japanese Science and Technology Agency's 30-year forecasts. The second sequence is that of critical technologies exercises, while the third one uses scenario-based methods [12].

Table 3. Selected chronology of foresight

Year	Delphi	Mixed	Panel/scenario/critical technologies
1970s	30 years in Japan		
1989		Ministry of Economic Affairs Netherlands	
1990	1st German		
1991 -			1st Critical Technologies USA
1992			Public Good Science Fund New Zealand
1993	1st South Korea		2nd Critical Technologies USA Technologies at Threshold of 21st Century Germany
1994	France Japan/Germany Mini Delphi	1st UK TF Programme	Ministry of Economic Affairs Netherlands
1995			100 Key Technologies France 3rd Critical Technologies USA
1996	Japan - German Delphi Austria		Matching S&T to Future Needs Australia Foresight Steering Committee, Netherlands
1997		ANEP Spain	Ireland
1998		TEP Hungary South Africa	New Zealand Sweden, 4th Critical Technologies USA IPTS Futures EU
1999 2000	2nd South Korea Japan 7th Survey	APEC Multi-economy Venezuela	2nd UK TF Programme FUTUR Germany National TF China; Brazil

The three generations of foresight are distinguished on the basis of research and development focus area, the economic rationales, actors and stakeholders, and other features. The First Generation Foresight rests in the domain of industrial and economic development. The Second Generation is related to the market perspective, while the Third Generation foresight focuses on combining STI with the socio-economic system and provides the arena for the necessary network connections. The First Generation foresight consists of technology forecasts. The Second Generation foresight combines technology and market perspectives, while the Third Generation foresight integrates technology, markets and the social dimension. The Third Generation activity implies the participation of social stakeholders and has an agenda of thematic, socio-economic problem-solving. In the current situation of meeting the challenges of globalisation, several exercises which began with a technology focus have come back with recommendations that focus upon the infrastructure for national innovation systems [12].

Table 4. A matrix of methods used in foresight exercises

Top 10	EU27 (485 cases & 1835 methods)	Trans-Europe (61 cases & 192 methods)	North America (109 cases & 328 methods)	Latin America (24 cases & 188 methods)	Asia (51 cases & 280 methods)	Africa (10 cases & 47 methods)	Oceania (15 cases & 35 methods)
1	Literature Review	Literature Review	Expert Panels	Other Methods	Expert Panels	Scenarios	Backcasting
2	Expert Panels	Scenarios	Futures Workshops	Expert Panels	Scenarios	Megatrend Analysis	Interviews

3	Scenarios	Expert Panels	Literature Review	Literature Review	Literature Review	Literature Review	Cittzen Panels
4	Other Methods	Futures Workshops	Technology Roadmapping	Environmental Scanning	Interviews	Futures Workshops	Questionnaire/ Survey
5	Futures Workshops	Brainstorming	Key Technologies	Brainstorming	Questionnaire/ Survey	Expert Panels	Megatrrend Analysis
6	Brainstorming	Megatrrend Analysis	Scenarios	Questionnaire/ Survey	Brainstorming	Essays	Trend extrapolation
7	Trend extrapolation	Trend extrapolation	Megatrrend Analysis	Interviews	Delphy	Questionnaire/ Survey	Delphy
8	Delphy	Other Methods	Interviews	SWOT	Trend extrapolation	Modelling &Simulation	Scenarios
9	SWOT	Modelling &Simulation	Essays	Scenarios	Megatrrend Analysis	Trend extrapolation	Brainstorming
10	Interviews	Questionnaire/ Survey	Trend extrapolation	Structural Analysis	Modelling &Simulation	Other Methods	Expert Panels

4. E-government in Lithuania: a Methodological Approach

E-government development forecasting and management is sophisticated due to its close links to the IT and public administration fields. The process of implementation of the e-government projects involves several social groups: scientists, business and public administration representatives, who have different interests and unequal sets of values on information. The purpose of the modelling is to assess the factors influencing the system, their importance and technological level. E-government forecast is based on an integrated approach of information technology and public administration. Due to this inherent duality the e-governance arises the conflict in validation of experts' estimation. The research goal is to develop the methodology and measurement techniques which are based on the selection factors that influenced group behaviour linked to e-governance decisions. The setting of the main factors' system usually starts from the analysis of secondary literature sources. The initial attempt to identify the key factors most often produces a long list of factors that must be revised and combined in an adequate list (e.g., positions 25-30). For example, the EVPGL Project (e-government to citizens: the development of guidelines for determination of Lithuania to the use of foresight methodology) was supported by the Lithuanian State Science and Studies Foundation in 2008 as well as the eGovRTD2020 project. The preliminary analysis of the literature referred to the list of 32 factors that may affect the e-governance development in Lithuania. The total number of factors was decreased to 26 by experts and analyzed by cluster method. The model includes assumptions in order to avoid errors in the measurement scales.

All of these internal and external factors were divided into three groups:

1. Management factors of the e-government development process,
2. Factors caused by e-governemtn development process,
3. Factors influencing the changes in the e-government development process.

Expert groups worked in three areas of expertise: "Science" (7 experts) included various academic institutions, engaged in e-government surveys; "Business" (10 experts) included various business institutions in relation to e-government projects and their representatives; "Public Administration" (9 experts) included government and local public administration authorities.

Cluster analysis is an exploratory data analysis tool for solving classification problems. Average coupling method calculates all possible clusters pairs' average distance

$$(d(r,s) = \frac{1}{n_r n_s} \sum_{i=1}^{n_r} \sum_{j=1}^{n_s} dist(x_{r_i}, x_{s_j}), i \in (1,\ldots,n_r),$$

$$j \in (1,\ldots,n_s)),$$

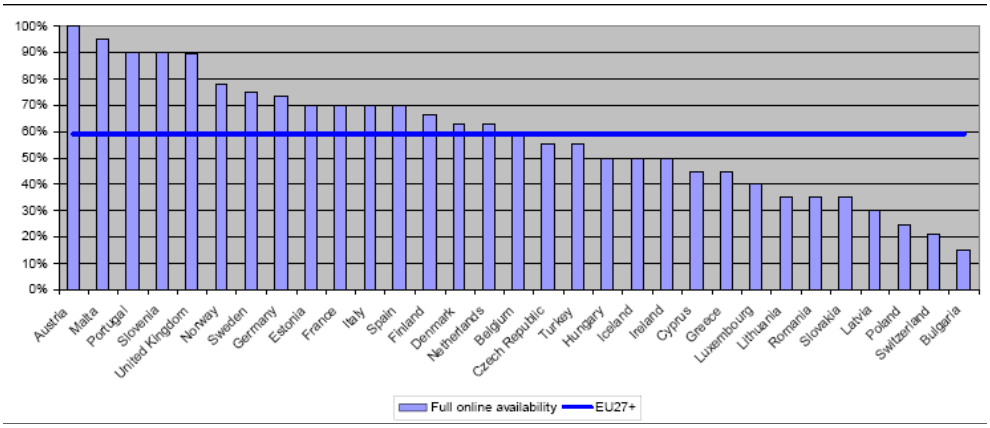
full coupling (Complete Linkage method) calculates the distance between the outermost points $(d(r,s) = \max(dist(x_{r_i}, x_{s_j}))$, the connection between the unit closest points $(d(r,s) = \min(dist(x_{r_i}, x_{s_j}))$.

Assumptions for cluster analysis were created. Data are interval in level or are true dichotomies for hierarchical and k-means clustering, though two-step clustering can handle categorical data. When at least

one variable is categorical, two-step clustering must be used.

The e-government system in Lithuania is implemented through the development of online public administration services. The process in still ongoing, and there are many positive results in health service system, municipal services, education system, e-democracy development, etc. The methodological principals became important in order to support the country foresight development and for evaluation procedures. The common trends towards e-service implementation by different countries are shown in Picture 5.

Picture 5. Individual country ranking regarding full online availability



Source: eGovernment Benchmark Survey, 2007. [9]

The EU Commission developed the levels of e-service availability for separate countries. Full online availability in Lithuania is 35%, and the leader is Austria with 100% online availability. The National Portal of Lithuania scores 71% on an average for the EU27+ of 75% which is progressive in comparison with Lithuania's general standing. Although not all services are accessible, the personalization and targetisation are good. Usability still leaves room for improvement [9].

Conclusion

The research explored the foresight methodological issues in order to develop an understanding of the importance of foresight for socio-economic development, for moving towards a knowledgeable and innovative society, and for the ability to implement science and technology innovations. The e-government system implementation in Lithuania was used as a platform to identify effectiveness of hierarchical cluster analysis method for expert assessment.

The e-government system in Lithuania has been implemented through the introduction of online public administration. According to the EU Commission report, the availability of online services in Lithuania has reached 35%.

The methodological study of e-governance services was conducted using the integrated cluster analysis method for expert assesment. Expert groups of scientists, business and public administration representatives, with different interests and scale of values conducted an evaluation of 26 factors affecting e-government solutions. The results show that the use of integrated methods for expert assesment could allow to develop recommendations for the strategic policy decisions.

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KONCEPTUALŪS ĮŽVALGŲ PLĖTROS PAGRINDAI

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Straipsnyje apibendrinti įžvalgų kūrimo etapai, tyrimų metodologijos evoliucija ir taikomi metodai. Tarpvalstybinis bendradarbiavimas ir tinklai formuoja naujos kartos įžvalgų modelius. Europos įžvalgų stebėjimo tinklas (EFNM) katalogizavo daugiau nei 2 000 struktūrinių, regioninių ir transnacionalinių įžvalgų. Siekiant formuoti socialines ekonomines įžvalgas, kuriomis galėtų remtis ūkio politikos sprendimai, būtina išplėsti empirinius tyrimus, įvertinti naudingą regioninių įžvalgų patirtį.

E. valdžios sistema įgyvendinama teikiant viešojo administravimo paslaugas internetu. ES Komisijai parengtoje ataskaitoje e. paslaugų prieinamumo lygis Lietuvoje buvo įvertintas 35 proc.

E. valdžios paslaugų metodologinį tyrimą atliko ekspertų grupės taikydamos klasterinį metodą. Ekspertų grupės – mokslininkai, verslo ir viešojo administravimo atstovai, turėdami skirtingus interesus ir vertybių skalę, turėjo vertinti 26 veiksnius, darančius įtaką e. valdžios sprendimams. Tyrimo rezultatai rodo, kad taikant integruotus ekspertinius metodus sudaromos strateginius sprendimus remiančios rekomendacijos.

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Eugenija Martinaitytė – Mykolo Romerio universiteto Ekonomikos ir finansų valdymo fakulteto prodekanė, docentė, socialinių mokslų daktarė. Turi projektų valdymo bei finansų rinkų ir ekonomikos plėtros tyrimų patirties, išleido apie 50 publikacijų.