

VILNIUS GEDIMINAS TECHNICAL UNIVERSITY FACULTY OF CIVIL ENGINEERING

TECHNOLOGY FORESIGHT AND SCENARIO PLANNING IN ENGINEERING

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Bialystok University of Technology, Poland

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Lecturers



Joanicjusz Nazarko, DSc, PhD, Eng Full Professor

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Past President (Rector) of Bialystok University of Technology (Poland). Currently serving as the Dean of the Faculty of Management and heads the Chair of Business Informatics and Logistics at the same institution. An Adjunct Professor at the Université du Québec à Trois-Rivières (Canada).

Invited member of the European Forum on Forward Looking Activities (EFLA) – a body established by the European Commission with the task of developing visions of the future and providing strategic advice in the area of research and innovation. Member of the Production Engineering Committee of the Polish Academy of Sciences, a Chair of the Podlasie Chapter of the Polish Society of Production Management, Editor of the "Journal of Engineering, Project, and Production Management" and an editorial board member for a number of other journals.

Chair of the IEEE Poland Section Technology Mangement Council Chapter.





- European Union's Rail Baltica Growth Corridor (EU Baltic Sea Region Programme 2007-2013)
 Coordinator on behalf of the Bialystok University of Technology
- Poland's National Foresight Program Results Implementation (Ministry of Science and Higher Education), 2011-2015 Coordinator on behalf of the Bialystok University of Technology
- Technological Foresight "NT for Podlaskie Region 2020" Regional Strategy for Nanotechnology Development (EU "Innovative Economy" Operational Programme), 2009-2012 Coordinator
- Scenarios in future shaping and anticipation in foresight studies (National Science Centre), 2011-2013
 Project leader
- Productivity analysis and assessment of research units (Ministry of Science and Higher Education), 2009-2012
 Project leader





Major Research Projects

- 6. Prospects and directions of the development of the structure and of new material and technological solutions concerning road surfaces within the terms of environmental protection and sustainable development (General Directorate for National Roads and Motorways in Warsaw), 2011-2014 Principal investigator
- 7. Hybrid methodology of technological foresight (Ministry of Science and Higher Education), 2010-2012 Project leader
- Multi-dimensional comparative analysis in the creation of university rankings (Ministry of Science and Higher Education), 2010-2012 Project leader
- 9. National Foresight Programme "Poland 2020" (Ministry of Science and Higher Education), (2006-2008), Member of Steering Committee





Łukasz Nazarko, PhD

Teaching and Research Assistant

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Areas of scientific interest:

- Foresight and Innovation Policy
- Corporate Foresight
- Foresight in International Relations
- Foresight evaluation
- Smart specialisation concpt

Research projects:

- 1. National Foresight Programme "Poland 2020"
- 2. National Foresight Programme results implementation
- 3. Technology Foresight <<NT FOR Podlaskie 2020>>
- 4. Foresight role in shaping country's innovation policy
- 5. Scenarios of technology development in road contruction

Lecturers

Main scientific achievements:

- Visiting research fellow at the University of Tokyo *Foresight impact on innovation* (2010)
- Implementation of pilot foresight projects in the Polish IT and logistics sectors (2011-2013)

Publications:

Sectoral foresight in Poland: thematic and methodological analysis, International Journal of Foresight and Innovation Policy 9 (1), 19-38, 2013

Drivers of Nanotechnology Development in a Polish Region: Foresight Study, XXIV ISPIM Conference, Helsinki 2013

The Essence and Perception of Foresight in Poland, Optimum, 2011

The Concept of Support Group in the Polish National Foresight Programme "Poland 2020", 2010 [book chapter]

COURSE PLAN



- 1. Welcome and Course Overview
- 2. Introduction to Foresight
- 3. Foresight Experiences Around the World
- 4. Overview of Foresight Methodology
- Description and Explanation of Selected Foresight Methods (e.g. Brainstorming, Expert Panels, STEEPVL, Cross-Impact Analysis, SWOT)
- 6. Scenario Based Planning
- 7. Scenarios Construction Process
- 8. Foresight in Construction Industry
- 9. Summary and Review

References



- L. Georghiou, J. Cassingena Harper, M. Keenan, I. Miles, R. Popper (eds.) *The Handbook of Technology Foresight. Concepts and Practice*, Edward Elgar Publishing, Inc. Northampton 2008
- 2. J. C. Glenn, T. J. Gordon, E. Florescu, 2013-2014 State of the Future, The Millennium Project 2014
- 3. M. Giaoutzi, B. Sapio (Eds.), *Recent Developments in Foresight Methodologies*, Springer 2013
- 4. A. Hines, P. Bishop (eds.), *Thinking about the future. Guidelines* for Strategic Foresight, Social Technologiies, 2006
- 5. G. Ringland, *Scenario Planning: Managing for the Future,* Wiley, Chichester; New York 2006.
- 6. UNIDO Technology Foresight Manual. Organization and Methods, United Nations Industrial Development Organization, Vienna 2005



PARTI

- ✓ Introduction to Foresight
- ✓ Foresight Experiences Around the World



Can Future be Predicted?

Everything that can be invented has been invented.

Charles H. Duell, Commissioner, U.S. Office of Patents, 1899

Sensible and responsible women do not want to vote.

~ Grover Cleveland, 1905



What use could this company make of an electrical toy?

Western Union president WILLIAM ORTON, rejecting Alexander Graham Bell's offer to sell his struggling telephone company to Western Union for \$100,000



[Television] won't be able to hold on to any market it captures after the first six months. People will soon get tired of staring at a plywood box every night.

> DARRYL F. ZANUCK, head of 20th Century-Fox, 1946

This 'telephone' has too many shortcomings to be seriously considered as a means of communication. The device is inherently of no value to us.

Western Union internal memo, 1876.

http://www.etni.org.il/quotes/predictions.htm

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Can Future be Predicted?

Heavier than air flying machines are impossible.

~ Lord Kelvin, President, Royal Society, 1895 There is no reason for any individual to have a computer in his home.

~Ken Olsen, President Digital Equipment, 1977 *I think there is a world market for maybe five computers.*

Thomas Watson (1874-1956), Chairman of IBM, 1943

[Man will never reach the moon] regardless of all future scientific advances. Who the hell wants to hear actors talk?

H. M. Warner (1881-1958), founder of Warner Brothers, in 1927

http://www.etni.org.il/quotes/predictions.htm



Attitude towards future in the modern society

For pre-modern societies the future is something that just happens, with individuals exercising only a limited influence over it.

For modern societies the future is something to be carefully thought about, influenced and, ideally, planned.

Anthony Giddens





foresight [/fɔrsaIt, foʊr-/] noun



provision for or insight into future problems, needs, etc.
 the act or ability of foreseeing

3. the act of looking forward





4. (*Surveying*) a reading taken looking forwards to a new station, especially in levelling from a point of known elevation to a point the elevation of which is to be determined

Collins English Dictionary – Complete and Unabridged © HarperCollins Publishers 1991, 1994, 1998, 2000, 2003

What is Foresight?



5. (*Firearms*) the front sight on a firearm

Collins English Dictionary – Complete and Unabridged © HarperCollins Publishers 1991, 1994, 1998, 2000, 2003

n. Perception of the significance and nature of events before they have occurred; care in providing for the future; prudence. The act of looking forward.



American Heritage Dictionary



- **FORESIGHT** Foresight involves taking a longer and broader view of decision-making. Foresight is used to provide early warning of emerging issues, understand challenges and opportunities, clarify vision and goals, and check the appropriateness and "robustness" of strategies. Foresight enables organizations, agencies, and communities to more wisely create their futures. Foresight is essentially about the future – a place for which there are no facts (it has not occurred yet). Key approaches to foresight include monitoring trends, developing forecasts and scenarios, checking assumptions and mental maps.
 - Institute for Alternative Futures, Wiser Futures Compendium 2011





Foresight methodology stems from the idea that "the future" cannot be predicted, but alternative futures may be imagined, explored, and assessed.

[Dan Grosu, A Systemic Approach to Knowledge Society Foresight. The Romanian Case]

Foresight is defined as a systematic, participatory process of building medium and long term alternative visions of the future, oriented at today's decisions and at mobilising common action.

[M. Keenan, I. Miles, 2001]

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Opportunity

NEXT EXIT



Foresight can <u>use</u> **forecasts**, as well as <u>contribute</u> to **planning**, but it should not be confused with either activity.

Forecasting tends to assume that there is one probable future, whereas Foresight assumes that there are numerous possible futures, and that the future is in fact there to be created through the actions we choose to take today.

As for **planning**, Foresight time horizons should be beyond the usual planning period. Time horizons will vary depending upon the issue or sector under consideration and the needs of the target audience. Time horizons typically vary between 5-30 years, but they may be even longer in some instances

Source: M. Keenan, 2006











Foresight Process

PROCESSES

Data Collection:

Potential future megatrends/issues are gathered from various sources of databases & publications as well as consultation or survey with expert panels and stakeholders.

Filtering:

Key issues are identified by using STEEP analysis. This analysis can gauge how the external environment will impact future development of country/region/sector/ company.

Analysis:

These key issues are further analyzed (SWOT) in terms of social and economic impact. The opinion of stakeholders on these key issues is evaluated.

Identification:

Final Megatrends/Key issues are identified. Analysis report of these key issues are provided.

Source: myForesight 2010

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Data Collection & Analysis

Data Collection

Filtering

Analysis

Trends Identification

Foresight Process

PROCESSES

Identify Drivers:

A broad range of drivers from the megatrends/future issues are identified by the STEEP analysis. Cross-impact analysis is then be carried out to identify interrelationships between these drivers.

Develop scenarios:

A set of scenarios is develop for detailed elaboration with description of each scenario in terms of its drivers, industry & market forces as well as plausible outcomes.

Scenarios Implication:

During the workshop, analysis of the scenarios is made to identify their implications and to generate a list of potential strategic actions. Focus on opportunities and threats for each scenario and across all scenarios.

Vision Building:

A vision building of the future constructed To along with the objectives/missions.



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Scenario Building

Identify drivers

Develop scenarios

Scenarios Implication

Vision Building

Foresight Process

Identification & Recommendations



PROCESSES

Shortlist candidates:

The key sectors/technologies which are considered to be important to fulfil the vision and goals are identified through various means & sources.

Filtering:

A set of rules/criteria/guidelines are identified or developed to provide filtering process. This process could be repeated.

Final list:

A final list of key sectors/technologies could then be produced after the filtering process with prioritization.

Source: myForesight 2010



What foresight can't do?

- Replace decision making! Difficult decisions will still remain, but should be better informed
- Overhaul a research or innovation system. It can contribute towards this, but is not enough on its own
- Always lead to consensus. But it can make known positions and foster mutual understanding
- Automatically lead to action. Commitment to implementation is required during and after exercises

Source: myForesight 2010







In 1969 the first 30-year technology forecasting programme started by Japan's Science and Technology Agency

encompassing all science and technology sectors and a wide range of experts from industry, universities and government organizations, in order to provide private and public decision-makers with views on possible long-term developments for broad direction-setting.

Now: already the results of the 7th Japanese S&T forecasting (including Delphi) study is out!

In the 1990s, foresight studies have been adopted by the governments of several other countries, among which, *Finland, Spain, Greece, Italy, Australia, New Zealand*.

Source: Arnold Verbeek, 2004



Foresight driving factors

Driving factors for the adoption of foresight by a growing number of national governments in the world are:

- The growing role of technology for industrial competitiveness, social and economic development calls for financial support from the government, especially for emerging technologies and strategic research, insufficiently supported by the market.
- The need for more systematic procedures for research priority-setting, foresight being a useful tool in this respect
- The emergence of a new 'social contract' between science and society and the search for better links between the interests of industry and society in relation to technology and innovation
- The creation of effective networks between industry, universities and government research laboratories, as a part of "wiring up" the national innovation systems for better learning processes and more effective innovation.
- The need to stimulate SMEs to use new technologies in their development
- Other functions, such as national direction-setting, anticipatory intelligence, generating consensus, communication and education.

Source: Arnold Verbeek, 2004





Foresight around the world

Key Drivers	Japan 🔴	ик	Finland	Korea 🏾 🍋 🏌
Environment & resources issues	 Increase issues that threatens earth sustainability; resources, energy, global warming 	 Climate change, resource competition, diseases & environmental impact Demand for new sources of energy 	Sustainable growth	 Continued dependence on others for energy & resources Increased interest in quality of life
Knowledge based society & globalization	 Advancement in globalization & knowledge information society 	 Globalization economic growth Chinese economic development Global inequality Growth in knowledge sharing 	 Globalization Changes in knowledge & ability Services innovation Global economy Changes in governance 	 Maturing of digital & network technologies Strengthening of knowledge based economies
Changes in population structure	 Rapid progress in aging & reduction of population 	 Population growth Changing demographics 	 Changes in population structure 	 Transition into super aged society Changes in lifestyle
Acceleration in convergence of S & T	 Rapid advancement of S & T fields such as IT, NT & BT 	 Advancement in technology ICT growth & expansion 	 Development of S&T Bio society Information & telecommunication 	 Balance of trade deficit in technology Convergence of technology Expansion of IT
Emergence of new security issues © myForesight 2010	 Increase issues that threatens earth sustainability; terrorism, disease 	 International crime & terrorism Illegal smuggling Proliferation of nuclear weapons 	 Changes in cultural environment Safety & security Well being & health 	 North-South Korea issue Northeast Asian regime



