CLASSIFICATIONS OF FORESIGHT METHODS

Abstract

Foresight exercises and programs are a formal process of applying a sequence of methods.

Classification of these methods is useful to specialists, academics and practitioners, in choosing an appropriate mix of methods used in foresight process.

In this article we take a brief review of the main classifications of methods of foresight.

In the first part of the article are presented information on stages and generation of foresight processes. The author proposes a new definition of foresight and a new classification of foresight exercises according to a given goal.

In second part are summarized the main simple classifications of the foresight methods used in literature.

In the third part of the paper we will be presented three complex classifications of methods foresight.

The article will conclude with a cluster grouping of the foresight methods based on their role in each stage of foresight and on the type of technique used.

Key words: *Foresight definitions, foresight phases, foresight generations, foresight methods typologies*

1. Introduction

Foresight exercises have known a dynamic trend over the past half-century both because of the assimilated methods and of their application.

According to (Georghiou L., 2001; Georghiou L. et. al., 2008) we can distinguish 4 generations of foresight depending on the applicability of the foresight process on different environments:

- First Generation: Foresight is here emerging from what are mainly technology forecasting activities, with the analysis driven mainly by the internal dynamics of technology. […]

- Second Generation: Foresight projects seek to grapple with technology and markets simultaneously. […]

- Third Generation: Foresight's market perspective is enhanced by inclusion of a broader social dimension, involving the concerns and inputs of a broad range of social actors. […]

- Fourth Generation: Foresight programmes have a distributed role in the science and innovation system, rather than being "owned" by a single policy sponsor. […]

- Fifth Generation: A mix of foresight programmes and exercises, also distributed across many sites but in combination with other elements of strategic decision-making. […]

Most foresight programmes at one time have contained elements from more than one generations […].

There is no need for countries to gradually go through the five generations of foresight.

As shown, the grouping in generations gives us the following trends in the evolution of foresight exercises:

- the tendency to increase complexity and abstraction level of foresight exercises, through the transition from technological to social environment;

- the tendency to increase involvement in decision making and control process, particularly the strategic aspect, in order to correctly implement the acquired results.

Based on these observations we can define *foresight* as the discipline dealing with the *management and marketing of the future*, in all aspects, from the *generation* process to its *implementation*.

We can safely assume that with the increasing complexity, the extent of abstraction and the degree of involvement of foresight exercises, the number of methods used have increased also.

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Voros, J. (2005) classifies prospective foresight exercises[2], in function of their impact on technology, into:

1. *Evolutionary* methods – seek to develop or evolve forward in time relatively continuously from a distinct starting point o configuration (usually in the present);

2. *Revolutionary* methods – seek to project or jump forward largely discontinuously into some distinctly different (future) state being, without necessarily a clear connection to the prior state.

In function of aims of prospective foresight exercises we can distinguish three types of exercises (Turturean C., 2011 SPODE).

1. *Replicator Foresight exercises*-their function is to find ways to reach the level of the leader economy / society/ technology. Therefore the function of these exercises is to replicate Foresight existing models.

2. *Innovative Foresight exercises*-their function is to create new and desirable futures. Therefore, Foresight function is to create desirable futures pioneering certain areas.

3. *Alternative Foresight exercises* - their function is to control and stabilize the routes to desirable futures already made by a previous replicator or innovative Foresight exercise.

Alternative and replicator foresight exercises have a evolutionary nature, while the innovative foresight exercises can be both revolutionary and evolutionary according to their innovative character.

In practice, it has been noted a correlation between foresight methods and the stages of foresight exercises in which they are used (R. Popper, 2008).
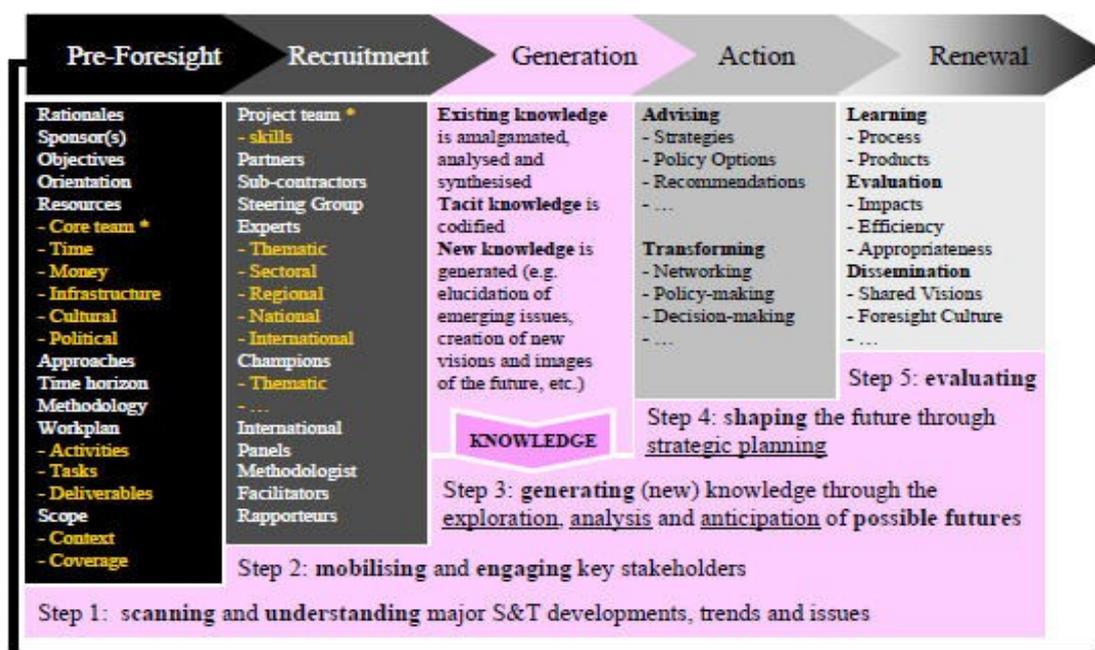

Figure 1. Stages of the Foresight process
Source: I. Miles, 2002; R. Popper, 2008

The stages of foresight exercises according to I. Milles (2002) and R. Popper (2008) are:
1. **Pre-foresight** or the **Scoping** *phase is the design's foresight phase in which the organizers along with sponsors established, by mutual agreement, the objectives and arguments of the exercise of foresight, form the working team and establish research methodology.*
2. **Recruitment** *phase added to the core team (scientific/ administrative coordinators and main thematic/ methodological experts), built in scoping phase, new members (e.g. process facilitators, rapporteurs and expert panel members, among others) which are also important for the foresight process .*

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[2] Original classification relates to methods of foresight but in terms of classification approach, corresponds to foresight exercises and not to foresight methods because the latter can not ensure the evolutionary or revolutionary feature. This feature is provided by the objectives of foresight exercises.

3. *Generation* is the most important stage of the process in which the existing knowledge is combined, analyzed and synthesized resulting new information and visions about the future. Generation phase consists of three stages characteristic: the exploration phase, the analysis phase and the anticipation of the future phase.

4. *Action stage* is the stage when the results of foresight should be disseminated so that it affects the decision makers. Stage action may affect prioritization, decision making, innovation and change.

5. *Renewal* is the phase of continuous monitoring and evaluation of the effects of foresight process and can provide some valuable information for pre-foresight stage corresponding to a future foresight exercise.

2. Necesitatea grupării metodelor de foresight

In the literature are frequently used 31 foresight methods (Theodore J. Gordon and Jerome C. Glenn, (2009)), or 33 foresight methods (Luke Georghiou et al. (2008)) and their numbers continue to grow.

The classification of foresight methods is an important tool for practitioners in their attempt to choose the most appropriate method in accordance with:

- The objectives of foresight exercises;
- The environment in which the exercise of foresight is applied ;
- The stages of foresight;
- The type of expected results from the application of the foresight exercise.

3. Foresight methods classifications
3.1. One-criterion classification of foresight methods

In this section we present classifications that are based on a single for classification criteria.

3.1.2 Classification of foresight methods by their nature

Simple Taxonomy of Futures research methods make by Theodore J. Gordon, Jerome C. Glenn, (2009) groups foresight methods in two clusters: *Quantitative and Qualitative methods*

Table 1

Classification methods by their nature

Qualitative	Quantitative	Semi-quantitative
Methods providing meaning to events and perceptions. Such interpretations tend to be based on subjectivity or creativity often difficult to corroborate (e.g. brainstorming, interviews)	Methods measuring variables and apply statistical analyses, using or generating (hopefully) reliable and valid data (e.g. economic indicators)	Methods which apply mathematical principles to quantify subjectivity, rational judgements and viewpoints of experts and commentators (i.e. weighting opinions)
1. Backcasting 2. Brainstorming 3. Citizens panels 4. Conferences/workshops 5. Essays /Scenario writing 6. Expert panels 7. Genius forecasting 8. Interviews 9. Literature review 10. Morphological analysis 11. Relevance trees /logic charts 12. Role play / Acting 13. Scanning 14. Scenario /Scenario workshops 15. Science fictioning (SF) 16. Simulation gaming 17. Surveys 18. SWOT analysis 19. Weak signals /Wildcards	20. Benchmarking 21. Bibliometrics 22. Indicators /time series analysis 23. Modelling 24. Patent analysis 25. Trend extrapolation / impact analysis	26. Cross-impact / structural analysis 27. Delphi 28. Key / Critical technologies 29. Multi-criteria analysis 30. Polling / Voting 31. Quantitative scenarios / SMIC 32. Roadmapping 33. Stakeholder analysis Source: R. Popper (2008)

Source: Popper R. (2008)

Luke Georghiou et all. (2008) added a new cluster to the two, the *Semi-qualitative methods* cluster, in their Classification on Methods by the *type of technique*: *Quantitative, Qualitative and Semi-quantitative methods.*

If the distinction between *quantitative* and *qualitative* methods is frequently used and maintained in all socio-economic sciences, the *semi-quantitative methods*

is the methods that apply mathematical principles to quantify subjectivity, rational judgments mathematical and viewpoints of experts of experts and commentators (i.e. weighting opinion or probabilities)" **(**Luke Georghiou et al., 2008).

3.1.3. Classification on methods by the type of approach

A typology of foresight methods is presented in the paper of Luke Georghiou et al. (2008) based on how the relationship with the future is established (Fig. 3):

- *Exploratory - if based on what known today, it examines what are the various possible futures;*
- *Normative – if based on how the future is expected or desired, it examines how a particular scenario could be reached or avoided.*

According to Michel Keenan (2006) the exploratory methods:

- *begin from the present, and see where events and trends might take us;*
- *begin with the present as the starting point, and move forward to the future, either on the basis of extrapolating past trends or causal dynamics, or else by asking "what if?" questions about the implications of possible developments or events that may lie outside of these familiar trends.*
- *frequently use tools like: Trend, impact, and cross-impact analyses, conventional Delphi, and some applications of models.*
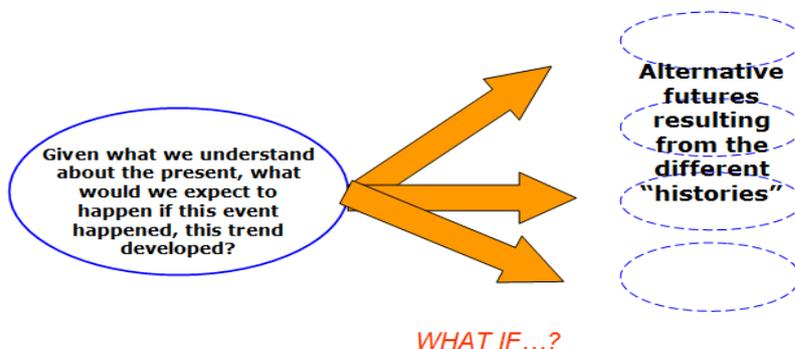

Figure 2. Schematic presentations of Exploratory Methods
Source: Michel Keenan

According to Michel Keenan (2006) the normative methods:

- *ask what trends and events would take us to a particular future or futures.*
- *start with a preliminary view of a possible (often a desirable) future or set of futures that are of particular interest.*
- *then work backwards to see if and how these futures might or might not grow out of the present – how they might be achieved, or avoided, given available constraints, resource and technologies.*
- *frequently use tools like various techniques developed in planning and related activities, such as relevance trees and morphological analyses*
- *use ,a fairly recent development, of "success scenarios" and "aspirational scenario workshops", where participants try to establish a shared vision of a future that is both desirable and credible, and to identify the ways in which this might be achieved.*
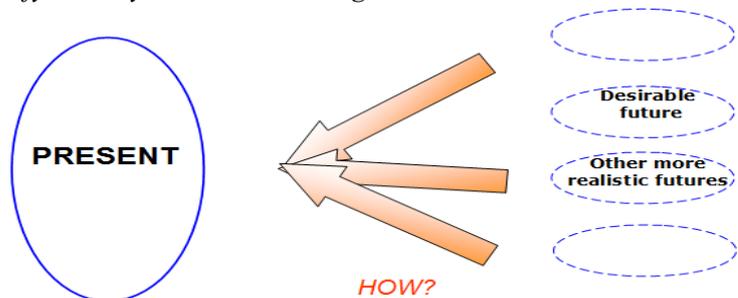

Figure 3. Schematic presentation of Normative Methods
Source: Michel Keenan

3.1.4. Classify of the foresight methods by frequency

Popper K. (2008), based on the analysis of 886 foresight exercises, establishes the foresight methods frequency of use. Thus he sorts the Foresight methods, depending on the frequency of their use:

- *widely used methods;*
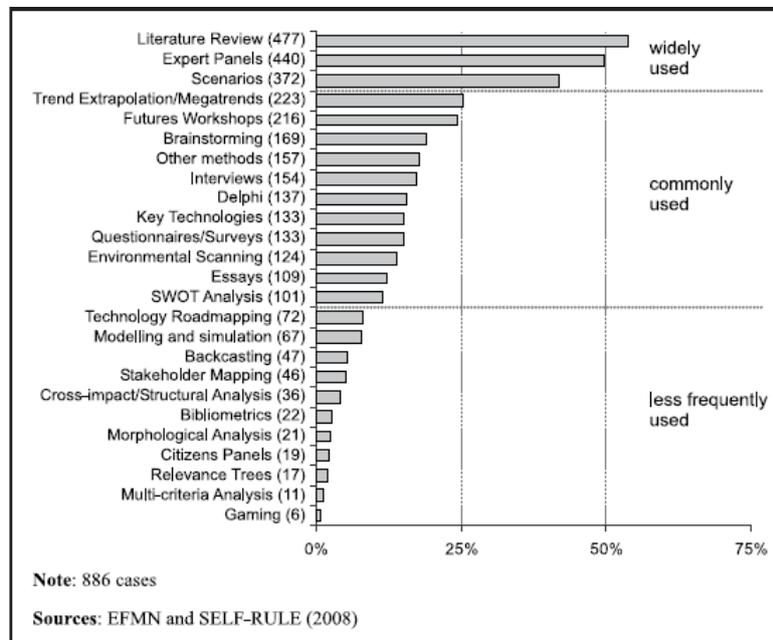- *commonly used methods;*
- *less frequently methods.*

Figure 4. Classify of the foresight methods by frequency

3.1.5. Grouping methods by potential contributions on foresight phases

Depending on their potential contribution of foresight stages, R. Popper proposed a classification method based on foresight presented in Table 2.

The classification of the 33 methods of foresight, figure 5, represents the methods of foresight on the principal axes resulting from a factorial analysis of potential contribution on foresight process stages'.

Methods that are located inside the square are methods which contribute approximately uniform in all stages of foresight.

Diametrically opposed methods, located outside the square (eg.: *Pooling Voting, Brainstorming, SWOT Analysis, Expert Panels, Citizen Panel* vs. *Bibliometrics and Patent Analysis*; *Forecast Genius, Sci Fi and Quantitative Scenarios* vs. *Stakeholders Analysis, Roadmapping and Citizen Panels*) are methods which can be found only exceptionally in the same level of foresight.
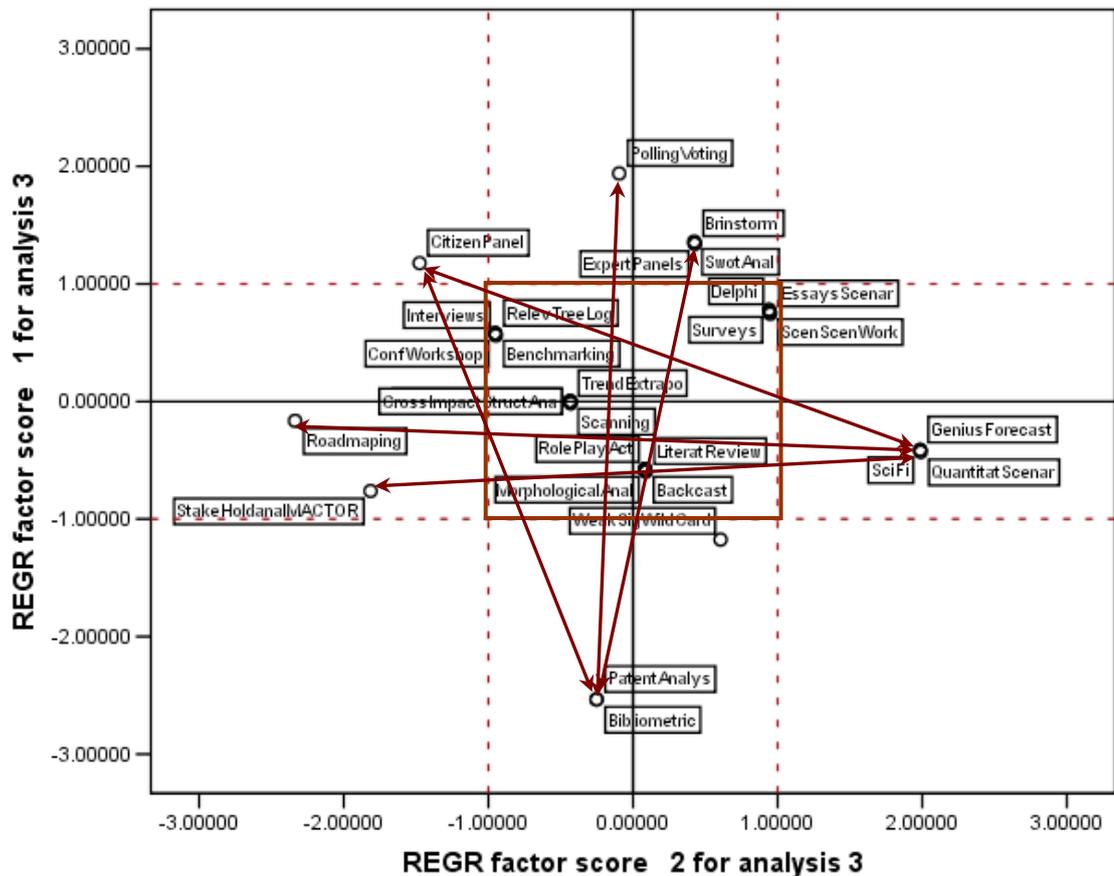
Figure 5. Classify of the foresight methods by potential contributions on foresight phases
**Sources:** *R. Popper (2008) and Self-Analysis*

3.2. Multi-criteria classification of foresight methods

In this section we present classifications that are based on multiple classification criteria.

3.2.1. Classification by the means of controlling and system understanding

In his book, Evaluation and Organization of futures research methodology v3.0, Mika Aaltonen (2009) makes a classification of the foresight methods, identifying four groups of methods, derived from their structuring after four criteria:

1. Mathematical complexity
2. Social complexity
3. Engineering Approaches
4. Systems thinking
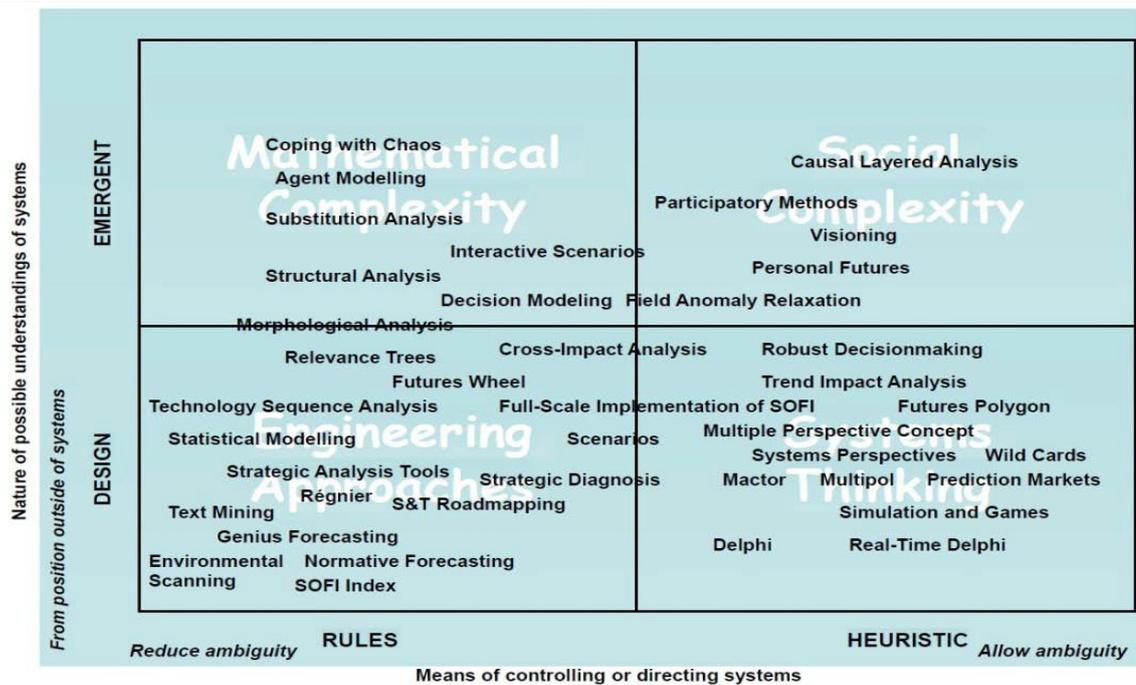
Mika Aaltonen (2009)

Figure 6. Classification by the means of controlling and system understanding

The differences between the four approaches are makes combining horizontal dimension with vertical dimension (Mika Aaltonen, (2009)):

- *In the **vertical dimension**, named **Nature of possible understanding of understanding of the system**, by **design**, we mean the ability of a manager, leadership group, expert or researcher to stand outside the system and design the system as a whole; with **emergent systems**, the system cannot be understood or managed as a whole by a manager, leadership group, expert, and researcher or by anyone at all, because the system emerges through the interaction of the agents (people, processes, technology, government etc.) that act on local knowledge and their own principles.*

- *In the **horizontal dimension**, named **Means of controlling or directing that system**, we contrast **rules** (which could be restated as "process") which remove ambiguity, with **heuristics** (which could be restated as "values") that provide direction with a degree of ambiguity that can adapt to different and changing contexts. There is a design element to emergent systems, but not in the same way as earlier, because there are various ways to influence the evolution of such systems, but they cannot be led by any agent.*

3.2.2. Classification by the type of knowledge source and nature of foresight methods

Another taxonomy of foresight methods, known as the diamond of foresight made by R. Popper (2008), groups them depending on their nature and on the sources of knowledge (R. Popper (2008)):

1. *Type of knowledge source*:
   - ***Creativity*** *– methods relying heavily on the inventiveness and ingenuity of very skilled individuals* vs. ***Evidence*** *- methods relying heavily on codified information, data, indicators;*
   - ***Expertise*** *- methods relying heavily on the tacit knowledge of people with privileged access to relevant or with accumulated knowledge* vs. ***Interaction*** *- methods relying heavily on the participations and shared views of experts and non-experts.*

2. *Nature of foresight methods*:
- *Quantitative, Qualitative and Semi-quantitative.*

Sources: *R. Popper (2008)*

Figure 7. Classification by the type of knowledge source and types of methods

3.2.3. Classification by potential contributions on foresight phases and nature of methods

A very useful classification for practitioners, resulting from the empirical analysis is presented by R. Popper (2008). This groups the methods according to their nature and their potential contribution on each of the foresight stages, Table 2.

From the information provided in Table 2 we obtain the potential contributions from the methods' groups by the nature of methods, in the foresight stages.

Table 2

Classification by potential contributions on foresight phases and nature of methods

	Methods / Activities	Foresight Phases					Type of method
		Pre-Foresight	Recruitment	Generation	Action	Renewal	
1	Backcasting	•	•	•••	•••	•	Qualitative
2	Brainstorming	•••	••	••••	•••	•••	
3	Citizens Panels	••	•	•••	**••••**	•••	
4	Conferences/Workshops	••	••	•••	•••	•••	
5	Essays/Scenario Writing	••	•	••••	••	•••	
6	Expert Panels	•••	••	••••	•••	•••	
7	Genius Forecasting	••	•	••••	••	•	
8	Interviews	••	••	•••	••	**••••**	
9	Literature Review (LR)	**••••**	••	•••	••	••	
10	Morphological Analysis	•	•	•••	•••	•	
11	Relevance Trees/Logic Charts	••	•	•••	•••	•••	
12	Role play/Acting	•	••	•••	•••	•	
13	Scanning	**••••**	••	•••	•••	••	
14	Scenarios/Scenario Workshops	•	•	••••	•••	••	
15	Science Fictioning (SF)	•	•	••••	•	•	
16	Simulation Gaming	•	•	•••	•••	•	
17	Surveys	•••	**•••**	••••	**••••**	•	
18	SWOT Analysis	••	•	••••	**••••**	••	
19	Weak Signals/Wild Cards	••	•	•••	••	•	
20	Benchmarking	**•••**	••	•••	•••	•••	Quantitative
21	Bibliometrics	**•••**	•••	••	•	•	
22	Indicators/Time Series Analysis (TSA)	**•••**	•	•••	••	••	
23	Modelling	•	•	**•••**	**•••**	•	
24	Patent Analysis	**•••**	•••	••	•	•	
25	Trend Extrapolation/Impact Analysis	**•••**	•	•••	••	•••	
26	Cross-impact/Structural Analysis (SA)	••	•	•••	•••	••	Semi-Quantitative
27	Delphi	•	••	**••••**	•••	••	
28	Key/Critical Technologies	••	•	•••	•••	••	
29	Multi-criteria Analysis	••	•	•••	•••	••	
30	Polling/Voting	••	••	**••••**	**••••**	•••	
31	Quantitative Scenarios/SMIC	•	•	**••••**	•	••	
32	Roadmapping	••	•	••	**••••**	••	
33	Stakeholders Analysis/MACTOR	••	•••	••	•••	••	

Legend of symbols: little/no contribution [•], some contribution [••], significant contribution [•••], major contribution [••••]

Note: the tables (above) provide an impressionistic view of the contribution that 33 methods might make to each phase of the foresight process. The "potential contribution" is represented with bullets. For example: *Backcasting* may have little/no contribution [•] in the *Pre-Foresight, Recruitment* and *Renewal* Phases, whereas significant contribution [•••] in the *Generation* and *Action* Phases

In Table 3 we note only the contributions in phases for which we obtained an average rating of more than two points and a coefficient of variation less than 35%, which shows that the mean is representative. Based on the results of Table 3 we can formulate the following conclusions:

1. qualitative methods are specialized for the generating and action stage;
2. quantitative methods are specialized for the generating and pre-foresight stage;
3. semi-quantitative methods are specialized for the generating , action and renewal stage.

Unfortunately we can see that we have no methods that are specialized in the recruitment stage.

Table 3

Contribuțiile potențială medii, cele mai importante și representative, a grupelor de metode după natural în etapele procesului de foresight

Method Type *by their nature*	Foresight Phase	Mean	Std. Dev.	Var. coeff.
Qualitative Methods (19- methods)	*Generation phase*	3.42	0.51	14.8%
	Action phase	2.84	0.69	24.2%
Quantiative Methods (6- methods)	*Generation phase*	2.67	0.52	19.4%
	Pre-foresight phase	2.67	0.82	30.6%
Semi-Quantitative Methods	*Generation phase*	3.13	0.83	26.7%

| (8 - methods) | Action phase | 3.00 | 0.93 | 30.9% |
| | Renewal phase | 2.13 | 0.35 | 16.6% |

3.2.4. Classification by the frequency and nature of methods

R. Popper (2008), based on analysis of a number of 886 foresight exercises, manages to make a classification of the most frequently used methods in foresight exercises depending on their nature.

In Figure 8 the results of this analysis are shown. It can be seen that the first three places are occupied by qualitative methods. They are very well represented in foresight processes.
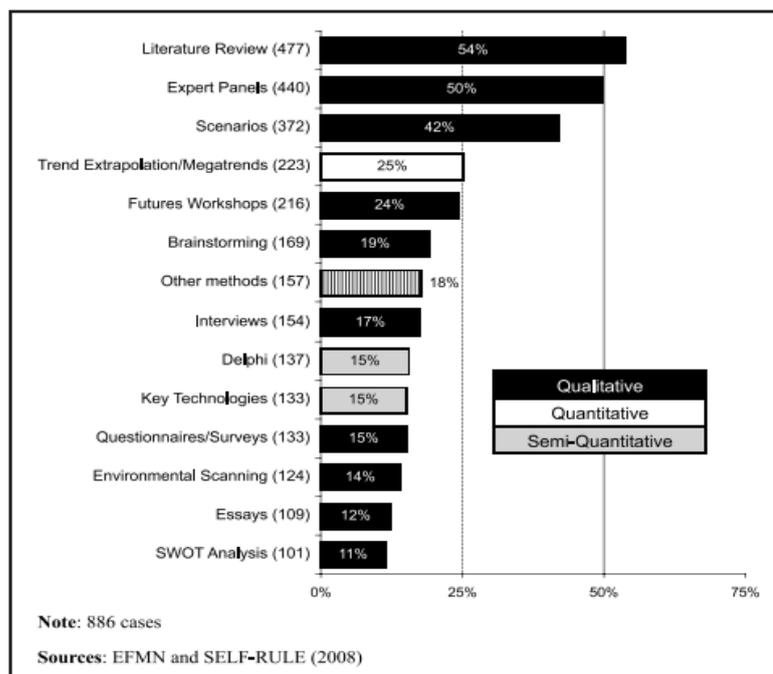
Figure 8 Classification by the frequency and nature of methods

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