Observatorio (OBS*) Journal, 5 (2008), 033-040 1646-5954/ERC123483/2008 033

IT Tools for Technology Foresight

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Abstract

The challenges of broadband society amplify the need of foresight research for designing science and technology policies. The success of a foresight study depends on bringing together different stakeholders, building consensus among divergent views and committing the policy makers to relevant action plan. The paper argues the use of advanced collaborative tools to support vision-creation activities. In particular, a special emphasize will be given to Group Support Systems (GSS) - a collection of software tools successfully used in the last two decades for strategic planning in industry. In addition to overcoming the temporal and spatial limitations of conventional meetings, GSS gives the possibility to have anonymous inputs that avoid individual inhibition and groupthink. The insights are drawn from our experience of using GSS technology in the FISTERA project - "Future Prospects in Romania: Scenarios for the Development of the Knowledge Society in Romania". For designing the scenarios we carried out an expert survey biased towards a structured brainstorming coupled with rating. The preliminary results identified the most relevant drivers (trends, issues and events) and clusters of views considered to be critical to the knowledge society development in Romania.

1. Introduction

Research foresight is the process involved in systematically attempting to look into the long-term future of science, technology, the economy and society with the aim of identifying the areas of strategic research and the emerging generic technologies likely to yield the greatest economic and social benefits (Martin, 1995). The common aims of foresight are: direction-setting, determining priorities, anticipatory intelligence, informing debate, increasing involvement, building social capital, building identities, advocacy, consensus – generation, communication and education. *In foresight research is commonly assumed that there are numerous possible futures and the future is influenced by the actions we take today.*

To describe the images of the future the scenarios term is commonly used as an analytical tool for assessing the impacts and the robustness of policy measures in case of unanticipated events (Enserink, 2003). The scenarios do not predict the future and do not prevent the unexpected from happening, they simply help institutions to be better prepared for unexpected events. For this reason, a sets of scenarios are defined to describe the possible futures not only one single scenario that can be considered the most likely to happen.

They are two types of scenarios: policy scenarios and context scenarios. Policy scenarios describe how the future would look like if specific alternative policies will be implemented successfully or partial successfully

or they won't be implemented al all. Policy scenarios usually present a wanted or unwanted future situation and depict how to reach that situation through different policies. Context scenarios depict possible futures despite different policies. In this paper we refer to the context scenarios methodological issues.

Scenario construction is a rare combination of art, craft and science, whereas the outcome of the process is often a mixture of creativity and rationality (Enserink, 2003). In order to design creative and plausible scenarios a good scenario-logic is required (the skeleton of all the scenarios that are created). It implies a deep understanding of the system under study and the identification of trends, issues and events that are critical to the system. In most cases, this identification process is a collective activity which brings subsidiary objectives to any scenarios design (Martin and Irvine, 1989): communication among a group of people, concentration of the participants on a specific problem and a further look into the future than they are used to do, coordination for productive partnership, consensus to create a shared vision of the future that participants would like to/expect to be achieve, commitment of the participants to implement changes in light of their foresight findings.

The requirement to have multiple interactions among participants in inter-organizational settings makes traditional scenarios construction workshop to be very slow. Time is very important so the participative process is under the pressure of being completed as soon as possible to minimize the cost and to receive benefit as quick as possible. Consequently, short and intensive workshops assisted with GSS are well-suited. GSS consists of a set of software, hardware, language components, and procedures that support a group of people engaged in a decision-related meeting (Huber, 1984). In addition to overcoming the temporal and spatial limitations of conventional meetings, GSS gives the possibility to have anonymous inputs that avoid individual inhibition and groupthink.

The remainder of this paper is organized as follows. Chapter 2 describes the typical process for scenario designing workshops. For the FISTERA project, this process is adapted and presented in chapter 3. Finally, our experience in employing this process is concluded in the last section.

2. Scenarios Designing Workshops with GSS

Numerous methods have been developed to create scenarios ranging from simplistic to complex, from qualitative to quantitative (Porter, 1985; Huss, 1988). Most methods have fundamental similarities, although they may have unique features and use different terminology. Generally, they recognize the need to understand the system under study and to identify the trends, issues and events that are critical to the system. In this section of the paper the classical process for creating scenario-logic with the use of GSS is briefly presented.

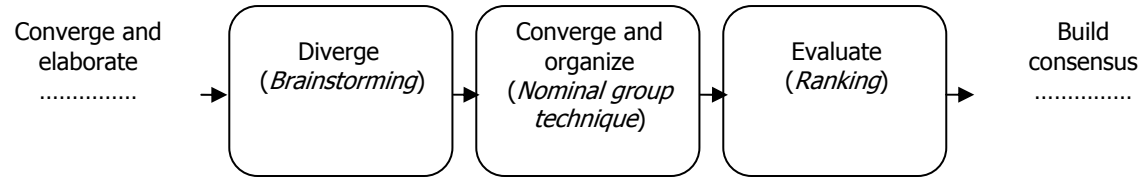

Fig. 1. The typical group decision process for scenario building (simplified from Enserink, 2003)

In the Fig. 1 are depicted the main activities, in the brackets is nominated the GSS tool with the help of witch we can accomplish these activities. Is worth to mention, that despite the employed technology, a GSS tool may create one of the five interaction patterns (Brigs, de Vreede, Nunamaker. 2003): diverge(move from having fewer to having more concepts), converge (move from having many concepts to focus on and understanding of fewer concepts), organize (move from less to more understanding of relationships among concepts), evaluate (move from less to more understanding of consequences for choices toward attaining group goals) and build consensus (move from less to more agreement among a group of stakeholders).

The first activity ("Converge and elaborate") consists in getting acquainted with the system and loosening up with an introduction to the topic by organizing a dialectical debate between participants. During this session the participants are confronted with a statement that they have to support or reject with arguments. The statement must be well prepared and should focus on key issues. In this fashion a lot of pro and con arguments are generated and the problem area is uncovered in a better way compared to a descriptive presentation.

The second activity is brainstorming on factors that influence the problem ("Diverge"). The objective of this activity is to get insight into all kind of factor or their relations. In this session we do not have to follow the traditional system of brainstorming composed of: generation, elaboration and organization. The results from this brainstorming are the basics for generating driving factors and trends.

In the third activity ("Convergence") a joint list of trends is created employing the Nominal group technique. Each participant is asked to make a short list of driving forces. After making his/her own list with trends each participant can send it to the public list, then the resulted list is further discussed and organized. In this way all driving forces are collected and before the next stage the participants already have a clear understanding of the meaning of the topics from the public list.

In the fourth step ("Evaluate"*),* the driving forces are ranked according to their impact/importance and to the uncertainty and/or unpredictability. For designing context scenarios the most important and the most uncertain trends are needed. The results from the ranking determine the basis for scenario elaboration. On the selected driving forces is important to have a clear consensus among participants. Even if in principle

the number of driving forces that can be considered for designing scenarios is unlimited, in practice however a limited number is selected.

In the final step ("Build consensus") a certain number of scenarios are selected for further detailing. It is important to have consensus on the selection of the driving forces without consensus problems might appear at a later stage of the scenario development process. The standard deviation is a one of the means to check if important differences in opinions exist. The whole process presented above can be repeated until consensus is reached.

3. A Simplified Scenarios Designing Process

The subject of our paper is the utilization of GSS tools in a foresight study, more precisely the FISTERA project. The aim of the study was to contribute to the pool of knowledge on foresight in Europe with updated information on the latest developments related to the Foresight programs or initiatives in Information and Communication Technologies (ICT) in Romania.

From the beginning the foresight study was under the pressure of generating credible results in very short time and with very low workforce. The approach strategy was to deliver results focusing on major issues (criteria, driving factors, trends, etc.) and shorting the conventional methodology described previously, clearly inapplicable in the given context.

The methodology followed in this study was focusing on providing the generative framework for scenarios building, also known as scenario logic or scenario skeleton. Despite the fact that going through the process of scenario construction is very important, it is widely accepted that the scenario logic is the main step and the basic requirement for designing creative, plausible and internally consistent scenarios. A context scenario type was chosen to show how the world might look like when the endogenous factors (effects of political will) and exogenous ones (factors that are independent and cannot be controlled by the policy makers) interact.

The scenario building process was following the classical framework of scenario workshops, but with significant distinctions imposed by the specific context (the second and third phase can be considered collaborative activities but in the study they were realized by authors themselves):

- identifying the relevant drivers (trends, issues and events together with their relative importance and their level of uncertainty) to the Knowledge Society Development (KSD) in Romania
- recognizing the driving forces (trends) behind the identified drivers.
- designing the scenario skeletons.

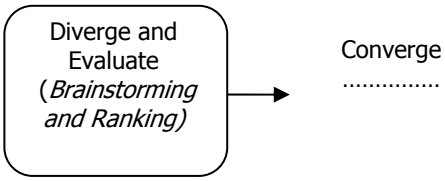

Fig. 2. The adapted scenario designing process

From the scenario logic pattern presented in the previous chapter only 3 activities were considered: diverge (brainstorming), converge and organize (nominal group technique) and evaluate (ranking). In the adopted methodology we used a bottom-up approach, so the activity four and two were merged together and conducted at the beginning of the process. For finalizing the process, activity 3 was not a collaborative one being accomplished by the authors. In this way, the conventional process has been transformed as depicted in Fig. 2: the drivers were ranked at the beginning and then clustered in driving forces to implicitly capture a high degree of consensus, importance and uncertainty. Of course the main advantage of this condensed process is its efficiency. To be effective, it requires a high number of participants in order to delineate the main clusters during the next step ("Converge"). In this fashion we have been able to identify the most important drivers, but inevitably overlooked some important ideas expressed by the participants.

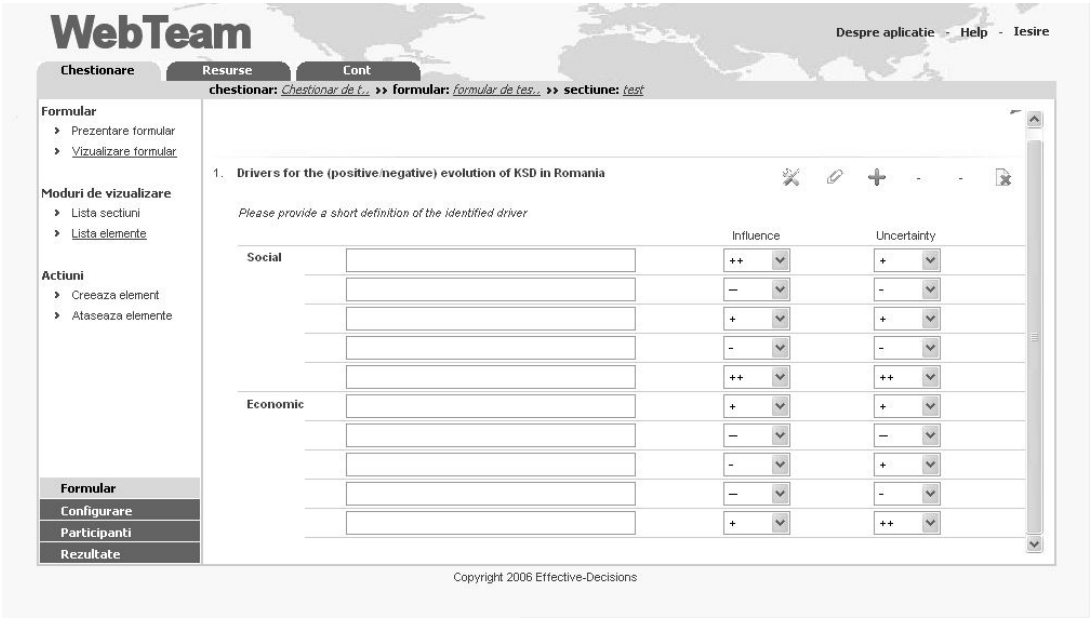

Fig. 3. The print screen of a GSS tool

The GSS tool that was used contains: survey, brainstorming and voting modules. The survey module allows survey creation with more than fifteen different types of elements. The participants can give the answers at any time from any place because the access to the GSS program is through Internet. If they desire, the participants can give anonymous answers as well. The results are generated very quickly. Using this tool was more efficient at least from the point of view of time-consuming process.

Consequently, in the first step a small-scale expert survey was used to identify in a ten years timeframe the most relevant drivers (trends, issues and events), cluster of views considered to be critical to the KSD and indicators for a successful KSD. In the survey the experts were asked to contribute with their views regarding the main drivers together with a short explanation of their impact on KSD in Romania. Next the experts were asked to evaluate the drivers by their importance and uncertainty regarding their future impact as shown in Fig. 3. The drivers that were evaluated as most important and most uncertain formed the basis for the identification of driving forces.

Te second step in designing scenarios workshop consisted in identifying the driving forces. The results of the survey have been divided according to their positive and negative influence on the KSD. In Table 1 (Zamfirescu, Filip, Bărbat, 2006) are represented the identified driving forces according to the STEEP dimensions. They represent drivers with the highest impact on the KSD and are accounting for the highest degree of consensus. The identification of the driving forces was accomplished by focusing on the positive and negative drivers with the highest uncertainty regarding their future development. In this way were identified those driving forces witch are potentially maximizing the positive drivers and minimizing the negatives ones. Based on the identified driving forces three relevant scenarios were selected (Zamfirescu, Filip, Bărbat, 2006).

Social	Social acceptance/rejection of IST[86].
o Predominance of social needs versus IST solutions o Insufficient awareness regarding social aspects of IST o General social doubt due mainly to minor improvement in quality of life.	
Technological	**User involvement in IST design (anthropocentric vs. technocentric perspectives on IST design)**
o Insufficient involving the end-users in every important IST development (ethnographic methods) o Distorting user needs in line with the trend to improve performance/price ratio (neglecting cognitive ergonomics, trends towards technological determinism etc.) o Predictable development of IST due to Moore's law	
Economic	**Seamless integration in EU market**
o Sound market-driven economic development under EU norms o Monopolistic tendencies in IST corporate culture o Unstable economic development in Romania combined with low progress in EU.	
Environmental	**Ecologically-driven attitude in designing and using IST**
o Validity of optimistic models regarding climatic changes o If ISTs are low polluting technologies, environmental factors are less important o Further neglecting of global changes and increased plausibility of pessimistic models.	
Political	**Group influences on general development**
o Successful efforts in swift integration in EU o Significant political influence of major IST companies degenerated by lack of transparency o Low progress in political stability in line with EU values (insufficient reduction of corruption, lack of transparency, failure of antiterrorist campaign)	

Table 1. Driving forces and their aspects for each STEEP dimension

4. Conclusion

In literature is generally recognized that the use of GSS in designing scenarios is very helpful for collecting and organizing the generated information. Using GSS leads to clear choices and preferences for limiting the number of the driving forces. Another advantage of GSS is the instantaneous availability for discussions of the results. The main disadvantages are the high costs of a complete GSS software suite together with its associated complexity for an effective use.

The employed methodology to design the scenarios skeletons proved to be very efficient. To be effective it requires a high number of participants in order to delineate the main clusters. In this way we have been able to sort out the most important drivers but, inevitably, overlooked some important ideas expressed by participants.

The scenarios designed during this project were not meant to be predictions of the future; instead, they depict a shared vision among the participants about the possible futures of KSD in Romania. They have been used later on as input for the elaboration of R&D National Strategy 2007-2013.

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