

Anticipating the Future of the Finnish Engineering Education Up to the Year 2015: Stakeholder Approach

*Mrs. Kati Korhonen-Yrjänheikki, Futurist, M.Sc.(Eng)
Education and Employment Policy Unit
The Finnish Association of Graduate Engineers TEK
katiky@tek.fi*

1. Introduction

This paper presents the research plan of the dissertation entitled “Anticipating the Future of the Finnish Engineering Education Up to the year 2015: Stakeholder Approach”. The first part of the empirical research of the dissertation, a Delphi panel for the decision makers of the Finnish engineering education was carried out during 2001 – 2003 at the Finnish Association of Graduate Engineers TEK in the engineering education anticipation and development project FuturEng that the researcher is heading.

The FuturEng project is continuing the co-operation of stakeholders in Finnish engineering education system. All key stakeholders are included in the project. The main objective of the project is to anticipate the key challenges of the Finnish engineering education in the Learning Society during the coming 10-15 years. The co-operation includes Decisionmaker Delphi panel (rectors of universities and polytechnics, industry leaders, policy makers and leaders of research organizations), workshops with students, faculty, alumni, industry, and case studies on Finnish universities and polytechnics offering engineering education.

In addition to the Finnish Association of Graduate Engineers TEK the project is funded by the Finnish Ministry of Education, The European Structural Fund ESF and three big Finnish companies: Nokia, UPM-Kymmene and Elisa Communications.

The FuturEng project will be finished 31st August 2004, when the summary of the key results of the project is published. Some key findings of the engineering education decision maker Delphi panel (see reference list for the make-up of the panel) will be presented at the CHEPS summer school. The researcher will continue the futures research on the Finnish engineering education also after the FuturEng-project aiming to finish Ph.D. studies year 2007 at the Helsinki University of Technology in the Department of Industrial Management.

2. Research Questions

Education is action that has a heavy orientation towards the future. It can be considered as an investment for the future of an individual, organization, nation or even the globe. That is why educational research and policy needs to use means of futures research to build scenarios on the future development that have an impact on the system of education. Based on the scenario work it is then possible to make strategic choices in educational policy. (Lehtisalo & Raivola 1999).

However, in Finnish educational policy, results of scientific research have been seldom or not at all utilized, when notable reforms in educational policy have been planned (Salminen 2000). It seems that research work has not been seen as a tool for educational planning. On the other hand, experimental results from other countries are used to support the solutions. Several researchers of the Finnish education are of the opinion that decision makers and educational politicians don't put enough emphasis on the change factors in the environment (Lehtisalo & Raivola 1999).

Because future does not yet exist we can't study it directly. However, it is possible to study future indirectly by studying factual things that have a bearing on the future. Formulation of possible, probable, preferable and threat scenarios collaboratively, enable better sensing of future challenges and responding to emergent challenges. In some cases it is even possible to reach a more desirable future path. (Bell 1996).

The Finnish ministry of education started first ESF funded programs on anticipation of education year 1996. In the development plan for higher education for the years 2003 – 2008 that is approved by the Finnish government it is planned to review the future challenges of higher education in the areas of structures, quality of education, funding and international competitiveness of the Finnish higher education (The Finnish Ministry of Education 2003). It is unclear whether this statement means thorough scenario work or not.

Currently only strategies, no scenarios or futures map, exist on the Finnish engineering education. There is limited understanding on the strong prospective trends and weak signals in the Finnish engineering education and is there a shared vision of the Finnish engineering education among the key stakeholders. And more specifically, what are the main differences in key stakeholders' views on the probable and preferable future development of the Finnish engineering education. According to Godet (2001) the attitude towards future is in that case either passive or reactive and the corresponding strategies "go with the flow" or adaptive. Godet argues that in a general level what is needed is an effective scenario and strategy process. That is proactive attitude resulting in desirable alternative scenarios and innovative attitude as well as preactive attitude resulting in trend-based scenarios and preventive strategy.

This study seeks to make an empirical contribution to aid to understand how different stakeholders of the Finnish engineering education anticipate engineering education to develop, what strong prospective trends¹ and weak signals² can be found and what are the main differences in stakeholders' opinions. The results should have high practical value for developers of engineering education and offer one starting point for a thorough scenario and strategy process for the Finnish engineering education. My aim is to apply the concept of futures map in the anticipation of the Finnish engineering education. Furthermore, my aim with the dissertation is to contribute theoretically to the body of knowledge on stakeholder management theories by applying them in futures research of engineering education.

¹ Kuusi (2004) defines strong prospective trend (SPT) as a trend identified by the developer community and that is supported by historical data. In this study the concept of strong prospective trend is defined to be a trend that is identified by key stakeholders of the Finnish engineering end that is supported by a historical trend or historical trends.

² A weak signal is a sign, which is slight in terms of present dimensions, but important in terms of its virtual consequences. It is an early warning of an opportunity or threat. See for example Kuusi (2004).

The overall research question of the dissertation is: ***What are the strong prospective trends and weak signals in the Finnish engineering education up to the year 2015?***

Lehtisalo & Raivola (1999) highlight the importance of identifying the change factors in the environment as a starting point, when developing the system of education. Key questions are: What are the important change factors? What kind of consequences do these change factors imply for the system of education? What kinds of uncertainty factors are there? However, the future of an individual or an organization is largely dependent also on its internal strengths and weaknesses (Godet 2001).

The main research question is approached by applying the conceptual framework of a futures map. When creating a futures map, three main challenges of futures research need to be faced: what is probable, what is possible and what is preferable (Kamppinen & Kuusi & Söderlund 2003). In order to find out what is possible current strengths and weaknesses are analyzed and strong prospective trends sought. Weak signals are important to identify in order to anticipate what is possible. By analyzing key stakeholders' interests, looking for shared vision and making up strategies for action, preferable development is formulated. Probable, possible and preferable developments are then all analyzed by formulating different scenarios on the future development.

In order to solve the main research question of the study it is first necessary to create a stakeholder map on the Finnish engineering education (Research question 1). This is done from stakeholder management theory perspective using models of Donaldson & Preston (1995), Mitchell & Agle & Wood (1997) and futures experts' perspective using classification of Kuusi (1999).

Research questions 2, 3a) and 3b) are stages in order to formulate the futures map for the Finnish engineering education and to solve the main research question. Primary and secondary stakeholders Delphi panels (the concept of primary and secondary stakeholders see Donaldson & Preston 1995) are used as a source of information in order to answer the research question 2. Literature study and secondary stakeholders' Delphi panel provide information and knowledge for the research question 3 a). And finally, literature study and primary stakeholders' Delphi panel are sources of information for the research question 3 b).

Research question 1:

What are the key stakeholders of the Finnish engineering education?

Research question 2:

What is key stakeholders' opinion on the main trends and weak signals in the Finnish engineering education up to 2015?

Research question 3 a)

What are the current strengths and weaknesses of the Finnish engineering education that support the main trends and weak signals identified by the stakeholders?

Research question 3 b)

What are trends and weak signals in the environment of the Finnish engineering education up to year 2015 that support the main trends and weak signals identified by the stakeholders?

3. Theoretical Framework

Stakeholder management theories and theories on expert knowledge offer the theoretical background for the dissertation. The stakeholders of the Finnish engineering education are identified and analyzed using stakeholder management theories and theories on expert knowledge.

Freeman (1984) defines the concept of stakeholder that it is any person, group or organization that affects and / or is impacted by the issue.

Donaldson & Preston (1995) classify stakeholders to primary, secondary and tertiary stakeholders based on the economic and / or legal stake they have in the issue. Primary stakeholders are those, who have direct economic and / or legal stake in the issue. Secondary stakeholders have a derived economic and / or legal stake in the issue. Those that are impacted economically or legally by the issue are tertiary stakeholders.

Mitchell & Agle & Wood (1997) argue that stakeholders can be classified based on one, two, or all of the following three attributes: power, legitimacy and urgency. The model consists of seven different types of stakeholders. Three classes of stakeholders possess only one attribute, three classes possess two attributes and one possesses all three attributes. One-attribute low-salience stakeholders are anticipated to have a latent relationship with managers. Stakeholders with two of the three attributes – power, legitimacy and urgency – with moderate-salience can be seen as “expectant stakeholders” and those stakeholder groups deserve management attention. When all three attributes are present the stakeholder salience is high and managers give priority to that stakeholder group’s claim. It is important to remember that stakeholder relationships are dynamic, so stakeholders can move from one stakeholder group to another. Seven stakeholder classes are:

Dormant stakeholders

The relevant attribute of dormant stakeholder is power. Dormant stakeholders are those who possess power to impose their will on an organization, but by not having legitimate relationship or urgent claim their power remains unused. Dormant stakeholders have little or no interaction with the organization, but management should be aware of them, because of the dynamic nature of stakeholder relationship. It is possible that a dormant stakeholder acquires second attribute and will become more salient. Although difficult, it is often possible to predict which dormant stakeholders may become salient.

Discretionary stakeholders

Discretionary possess the attribute of legitimacy, but they have no power to influence the organization and no urgent claims. Because of absent power and urgent claims, there is absolutely no pressure on managers to engage in an active relationship with such a stakeholder, although managers can choose to do so. Discretionary stakeholders are a particularly interesting group for scholars of corporate social responsibility and performance.

Demanding stakeholders

Demanding stakeholders are those that have urgent claims, but no power or legitimacy. They are irritating “mosquitoes buzzing in the ears”, but not dangerous and do not deserve more than passing management attention if any at all.

Dominant stakeholders

Dominant stakeholders are those that are powerful and legitimate. They have legitimate claims on the organization and are able to act on these claims. Dominant stakeholders usually have some formal mechanism in place that acknowledges the importance of their relationship with the organization and organizations produce different kinds of reports, like annual reports, to them. Dominant stakeholders importance to the organization is evident and they receive much of management attention, but they are by no means the only important stakeholder group like it is often believed.

Dependent stakeholders

Dependent stakeholders have urgent legitimate claims but lack power. Power in the relationship is not reciprocal, but power can be achieved either through the advocacy or guardianship of other stakeholders or through the guidance of internal management values.

Dangerous stakeholders

Those stakeholders that have urgent claims and have power, but lack legitimacy are coercive and possibly violent to the organization and are therefore called “dangerous stakeholders”. The actions of these stakeholders are sometimes not only illegitimate, but dangerous both to the stakeholder-manager relationship as well as to the individuals involved. Identification of dangerous stakeholders is important for reducing the risks that dangerous stakeholders bring.

Definitive stakeholders

Definitive stakeholders are those that have all three attributes: power, legitimacy and urgency. Any of expectant stakeholders - dominant, dependent or dangerous - can become a definitive stakeholder by acquiring the missing attribute.

Kuusi (1999) dives basic types of expert knowledge in three different classes: scientists, decision makers and synthesizers. These basic types of futures-oriented expertise get different weights in different futures-oriented activities. Kuusi argues that when making mission scenarios the order of importance of different types of expert knowledge is decision makers, synthesizers and scientists. In the case of issue scenarios the order of importance would be scientists, synthesizers and decision makers. Whereas, when making action scenarios the most important expert group would be synthesizers, then scientists and finally decision makers.

4. Approach & Methodology

The study can be characterized as a futures research project that is carried out using futures map as a conceptual framework and Argument Delphi and literature study as methodological tools. The scope is limited to engineering education system in Finland. However, although the main focus of the study is on the Finnish engineering education, several of the challenges of the engineering education in the Information Age are global. In the level of European Union even more, bearing in mind the strong political intent manifested in Sorbonne and Bologna declarations to develop “A European Higher Education Area” by the year 2010.

4.1 Futures Map As a Conceptual Framework

When preparing a futures map the importance and order of different stages varies depending on the issue researched and do other futures maps on the issue exist. Kamppinen & Kuusi & Söderlund (2003) present one possible process for creating a futures map:

1. Description of the current situation
2. Shared vision
3. Identification of strong prospective trends
4. Identification of weak signals
5. Preparation of scenarios
6. Elaboration of strategies for action for each of the scenarios
7. Actions in the near future

The stages 6 and 7 are out of scope of the dissertation. The dissertation consists of two separate futures map creation processes and a third process, where these two futures creation processes are combined.

The first futures map process is carried out with a primary stakeholder Delphi panel. Literature study in this process is used for the description of the current situation.

1. Identification of main trends in the Finnish society up to the year 2015 (Primary stakeholders' Delphi panel)
2. Identification of weak signals in the Finnish society up to the year 2015 (Primary stakeholders' Delphi panel)
3. Preparation of scenarios on the development of Finland up to the year 2015 (Primary stakeholders' Delphi panel)
4. Identification of main trends in the Finnish engineering education according to the primary stakeholders' Delphi panel
5. Identification of weak signals in the Finnish engineering education according to the primary stakeholders' Delphi panel
6. Preparation of scenarios on the Finnish engineering education system structure, degree structure and functions of universities and polytechnics (Primary stakeholders' Delphi panel)
7. Is there a shared vision among stakeholders on the future of Finland and the Finnish engineering education up to the year 2015?
8. Description of the current situation in the Finnish engineering education (Literature study)
9. Identification of main trends in the Finnish engineering education (Primary stakeholders' Delphi panel and literature study on the current situation of the Finnish engineering education)
10. Identification of weak signals in the Finnish engineering education (Primary stakeholders' Delphi panel and literature study on the current situation of the Finnish engineering education)

The second futures map process is carried out with a secondary stakeholder Delphi panel. In all of the stages listed below, the source of information is secondary stakeholders' Delphi panel.

1. Description of the current situation
2. Identification of main trends in the Finnish engineering education
3. Identification of weak signals in the Finnish engineering education
4. Is there shared vision?

In solving the main research question of the dissertation these two futures map processes are combined. The main focus is on stages 3, 4, 5 and 6 that form the core of the main research question. The process is as follows:

1. Description of the current situation (Literature study and secondary stakeholders' Delphi panel)
2. Identification of strong prospective trends in the environment that seem to have an impact on the Finnish engineering education (Primary and secondary stakeholders' Delphi panels and literature study)
3. Identification of weak signals in the environment that may have an impact on the Finnish engineering education (Primary and secondary stakeholders' Delphi panels)
4. Identification of strong prospective trends in the Finnish engineering education (Primary and secondary stakeholders' Delphi panels and literature study)
5. Identification of weak signals in the Finnish engineering education (Primary and secondary stakeholders' Delphi panels)
6. Is there shared vision? (Primary and secondary stakeholders Delphi panels)
7. Preparation of scenarios on the Finnish engineering education (Primary and secondary stakeholders' Delphi panels and literature study)

4.2 Argument Delphi

The Delphi method in general can be characterized as a method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem. It does this by identifying the underlying reasons for different opinions, rather than aiming at high statistical validity with a large respondent group. Other advantages of the method are seen to be related to its ability to convert expert opinion on the issue, in the case where not only one right answer exists. (Linstone & Turoff 1975).

Several different variations of the Delphi method exist. However, anonymity, feedback and iteration (several rounds) are key elements of all Delphi studies. The key success factor to a Delphi lies in the selection of the panelists. Since the results of the Delphi depend on the knowledge and co-operation of participants, persons who are likely to contribute valuable ideas are essential to include. It is also important that respondent group members represent the research issue from different perspectives. (Gordon 2002, Kamppinen & Kuusi & Söderlund 2003).

The application of Delphi used in this study is a variant of the Policy Delphi. The variant is called Argument Delphi (AD) because it is focused on the production of relevant factual arguments. The panelists are informed about the names of other participants, but responses are given anonymously. The main purpose is to make the panelists to argue seriously. Typical of Argument Delphi is that the first round questionnaires are replaced with expert interviews. In the first round interviews only Delphi managers (researchers) have direct contact with the panelists. (Kuusi 1999, Kamppinen & Kuusi & Söderlund 2003).

The focus when using Argument Delphi should be very specific, a single issue area or a single issue (Kuusi 1999). In the present study the issue area is the Finnish engineering education system. When using the Argument Delphi, it is reasonable to evaluate the relevancy of each stakeholder group and what kind of expertise they bring to the panel. Moreover, each stakeholder group's power to influence and communication policies should be evaluated. Kuusi (1999) argues that the Argument Delphi process is more useful if core customers participate in the argumentation process.

4.3 Validity and Reasonability in Foresight Studies

Kuusi (1999) makes a distinction between three types of the reasonability of a judgment in foresight studies. These are predictive reasonability, option reasonability and commitment reasonability. Every future topic can be viewed from all three perspectives. However, different types of reasonability are relevant in different situations.

The epistemic value of a Delphi study depends on the type of reasonability expected. In other words, the criteria of how to measure the success of a Delphi study are different depending on what kind of reasonability: predictive, option or commitment the study is aimed.

The future topics can be divided into three types based on the motives of anticipation (Kuusi 1999):

“1) A topic is asked, which cannot be affected by the action of panelists or the customers of the study. In this situation, predictive reasonability dominates. Panelists have to look at the future topic as outsiders.

2) Panelists or their customers may have an impact on the anticipated future, but they are especially in lack of relevant decision alternatives or relevant future options. In this situation, the option reasonability dominates in the argumentation and in the making of judgments.

3) Panelists or customers have an impact on the anticipated future and they know relevant future options well enough, but realization of the options depends on the coordinated action of many decision makers. In this situation the commitment reasonability dominates the argumentation.”

Option reasonability and commitment reasonability are most relevant in Argument Delphi studies, like the present study.

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The participants in the primary stakeholder Delphi panel were:

Aho, E. Parlamentarist.; *Alaniemi, M.* Director. Jyväskylä Polytechnics JYPOLY.; *Carpen, M.* President. ElisaCom.; *Eloranta, E.* President. Nicefactory; *Eriksson, J-T.* Rector. Tampere University of Technology TTY.; *Granholm, M.* Vice President. UPM-Kymmene.; *Hassi, S.* Parlamentarist (in the beginning of the Delphi process Minister of Environment); *Ihamuotila, R.* Chancellor. Helsinki University.; *Konttinen, M.* Vice President. STAKES National Research and Development Center for Welfare and Health.; *Kuusi, J.* President. Nokia Research Center.; *Lahtinen, M.* Rector. Tampere Polytechnics TAMK.; *Leppävuori, E.* VTT Technical Research Center of Finland.; *Linna, M.* Secretary General. The Finnish Ministry of Education.; *Lukka, M.* Rector. Lappeenranta University of Technology. LUT.; *Mattila, M.* Director of University Division. The Finnish Ministry of Education.; *Niinivaara, M.* President. ABB Finland.; *Saarnivaara, V-P.* Director General. TEKES National Technology Agency of Finland.; *Sillanaukea, P.* President. FitBiotech.; *Törmälä, P.* Rector. Espoo-Vantaa Polytechnic EVITECH.; *Uosukainen, R.* Speaker of the Parliament.; *Uronen, P.* Rector. Helsinki University of Technology HUT.