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The role of the technology barometer in assessing the performance of the national innovation system

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ABSTRACT

Along with increasing significance of innovation in socio-economic development grows the need to utilize future-oriented knowledge in innovation policy-making. Foresight and road-map exercises are aimed at supporting planning and priority-setting of R&D and have become indispensable elements of policy-making. Besides technological development decision-makers need all-inclusive knowledge of future developments of society, economy and impacts of science and technology. When the worldwide competition is about the attractiveness of innovation systems, such knowledge is important for comparing the innovation performance of nations to other economies. Finland is among the countries improving her position in worldwide performance comparisons since the late 1990s and reached leading nations in early 2000s. This attainment raised national interest and critical debate of the reliability of the data basis and methodologies used in comparisons. In The Finnish Association of Graduate Engineers (TEK) this discussion led to a decision to develop an own comparative exercise together with VTT. In addition to performance analysis based on ex-post indicators the barometer includes the questionnaire of the views and visions of the future development by relevant national actors. The theoretical framework of the barometer is based on the evolution of economies from industrial development phase to sustainable knowledge society. The barometer has been undertaken in 2004, 2005 and 2007, and a wide interest and emerged discussion of barometer proves that a social interest and order exists for the barometer. The article presents the background, methodology and results of technology barometer, discusses its impacts on national discussion, and gives perspectives for the future development of barometer.

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1. Introduction

A growing number of different international comparison systems of the economic and innovation performance of nations have emerged within a decade [2]. The role of performance comparisons has become increasingly important in the era of globalization when competition is not only between multinational and other enterprises but also between economies and innovation systems. Comparisons are based on a number of different indicators, composite indicators or survey based studies providing comparisons in a wide range of fields like economy, society, education, innovation system, or sustainable development. Although useful in benchmarking of country performances, indicators, if poorly constructed, can convey misleading policy messages [1,2]. For example composite indicators illustrate complex and sometimes even elusive issues and they often seem easier to interpret by the

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general public than finding a common trend among many separate indicators. Accordingly composite indicators must be seen as starting points for initiating discussion and attracting public interest [1,2].

Finland has improved her position among developed nations according to several international performance comparisons since the latter part of 1990s, and soon in early 2000s reached a position among leading nations for example according to competitiveness reports of IMD and World Economic Forum (WEF). Although Finnish policy-makers, industrial community, scientists and citizens have followed international comparisons and related discussion with great interest, there has been a growing national controversy regarding the reliability of international performance comparisons and challenges associated with their use for national policy purposes. The criticism is related to the ways data and methodologies are used in comparisons. For example, one problem of comparisons based on composite indicators is that they give a backward looking "mirror" perspective, i.e. they are based only on past and often outdated data, and not on examination of future development. Gradually this debate led in The Finnish Association of Graduate Engineers (TEK) to the decision to develop an own national performance comparison. Technology barometer was developed in order to measure the scientific, technological and socio-economic state and development level of the nation and for making related comparative analysis to other nations. From the start TEK included in the barometer both a comparative study of reference countries, based on indicators of past development, as well as a future-oriented survey exploring future visions of relevant national actors like industries, policy-makers and politicians, research community and future generations, i.e. young citizens. Consequently the barometer gives both a compilation of ex-post data and strategic perspectives on how well the Finnish innovation environment is positioned now and how competitive it is assessed and expected to be in the future.

The Finnish Association of Graduate Engineers developed a technology barometer in collaboration with VTT Innovation Studies during 2002–2003. The first technology barometer was published in 2004 and since then that barometer has been repeated twice in 2005 and 2007 [3–7]. The plan is to publish a barometer once in every two to three years. The content of the technology barometer will be further developed in appropriate ways, however, without jeopardizing its comparative nature so that the comparison of indicators of latest exercise to those of previous barometers remains possible.

2. Theoretical framework and methodology

Technology barometer is a societal indicator instrument with a strong emphasis on the innovation environment. The instrument describes the long-term development of competencies and resembles economic, industrial and business barometers in its attempt to grasp future developments. The purpose of a technology barometer is to give data of how favorable and competitive the Finnish innovation environment is assessed to be now and in the future. The future development of the economy and innovation system will be in part derived from the path dependent historical context and accordingly future-oriented knowledge shall be properly interlinked to the past development path. In technology barometer this challenge is solved by dividing the exercise first into a comparison of the performance of the Finnish innovation system with selected nations on a basis of available international indicators, and second, to a technology barometer based on a survey study of the visions and attitudes of relevant national key actor and interest groups. Indicator-based country comparisons reveal the strengths, weaknesses and related possible areas for intervention and policy-making, whereas the forward-looking survey enquires and identifies possible areas for development activities in national innovation policy in the future. Both parts are structured in a similar way enabling the linking of ex-post and ex-ante analyses mutually when drawing conclusions and making interpretations and policy implications on the basis of the barometer results.

2.1. Theoretical framework

It is important for composite indicators, or any indicator system in that case, to have a sound theoretical and methodological basis [1,2]. Technology barometer is based on the studies of the dynamic evolution of various development stages of a modern society after the industrialized development stage, i.e. from an information society into a knowledge society and from that towards a knowledge-value society. At the same time, it also indicates how effectively the development in question complies with the principles of sustainable development. The technology barometer instrument utilizes the concepts developed by contemporary social scientists and innovation theorists, such as Bell [8], Masuda [9], Sakaiya [10] and Castells [11–13]. For example, the Japanese futurist Yoneji Masuda and the American sociologist Daniel Bell have stated that the essential dimensions of a new society would be seen in the emerging service economy, the role of theoretical knowledge, and technology development.

The theoretical framework of transitional phases of economies created by contemporary social scientists was widely accepted as the platform for constructing the barometer instrument. The data used by the barometer illustrate transitional phases and provide an overall image of how far the developed nations have come in a journey towards a knowledge-value society. The various economic development phases form a context incorporating the significant socio-economic changes and dynamics into the analysis. The framework enables the structural comparisons of entire economies, their individual industrial sectors, related R&D and innovation intensities, and respective socio-economic changes. Structural characteristics, dynamics and knowledge intensity differ essentially also among developed economies, and the entire economic systems or their sub-systems are in different development phases. Thereby the inclusion of transitional phases of economies to the comparative analyses of economic and innovation systems deepens the understanding of the long-term socio-economic changes and dynamics. Moreover, performance comparisons are often based on input data for developing innovation systems, like private and public R&D investments, albeit the most important data is related to outcomes and impacts of inputs, like embedding of ICT into private and public sectors and consequent productivity increase.

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