



AN APPROACH TO EVALUATE INFLUENCE OF EUROPEAN UNION INNOVATION POLICY TO INCREASE THE ECONOMIC EQUALITY BETWEEN MEMBER STATES

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Abstract. European Union authorities consider innovations as a powerful tool to increase EU economic equality between members. This study represents few issues related with innovations in EU. At first, the EU documents and European scoreboard are analyzed according to structural analysis means of proposed approach. The innovational gap between EU member-states is identified. Second part of the article copes with methodological issues that arose around the research of innovations. The major issue related to an innovations measuring is that innovations consist of both tangible and intangible elements. The methods of the 4th generation of measuring innovation are implemented in the research, which aims to evaluate EU policy according to population's perception of innovations in Lithuania and Romania. Comparative study between Lithuania and Romania is done. The research shows social attitudes towards innovations and its relation with life quality and financial situation. The study shows, that local consumption of innovative products and services not necessary leads to better innovativeness of country.

JEL Classification: P000, P510.

Keywords: innovation policy, measurement of innovations, the European Union, statistical evaluation.

Reikšminiai žodžiai: inovacijų politika, inovacijų matavimas, Europos Sąjunga, statistinis vertinimas.

1. Introduction

In the early 80's the erosion of traditional industrial policy started, since it has not managed to ensure adequate growth of the European economies. Unlike other major world economies, the deindustrialization and transformation of economy towards the innovation in Europe were hampered. This stall was caused by severe restrictions on the economies and political fragmentation (both internal and transnational). However, over the past twenty years, this shift towards innovation-based economy is becoming more and more accelerated. Admittedly, because of the above-mentioned problems of the European Union's innovative system lagged quite far behind the United States of America and Japan and the backlog has remained until now (European innovation scoreboard, 2009). This lag of innovation processes is growing concern in the European Union authorities.

The importance of innovations is growing; both policy makers and academics are more and more interested in the possibilities that are brought by innovations. The term "innovation" in the modern sense was used for the first time by Schumpeter (1934), that noted five cases of innovation: the introduction of a new good, the introduction of a new method of production, the opening of a new market, a new source of supply of raw materials, and a new organization of industry—the creation of a monopoly position, for example.

But only at the end of the 20 century, it has been finally realized that innovation is a pivot that can and should push modern economies. Countries and global organizations started to define and to collect data related to innovation processes. The OECD in its Oslo Manual (1996) defines innovation as new or significantly improved products or production processes of implementation and delivery. The third edition of the Oslo Manual (2005) extends the definition by including new methods of organization of business activity, labour organization or external relations. U.S. Department of Commerce (2008) defines innovation as new or improved products, services, processes, organizational structures and business models, design, development and implementation in order to create additional value for customers and financial return to the firm. Despite these wide definitions policy makers are likely to continue to think about innovations essentially as inventions which can be stimulated by support of R&D investment. In fact, the science-push model based on R&D is still the most dominant model in the use today by both academics and the policy community. Its continued success is partly due to its successful incorporation of many of the features of modern innovation theory (Claire Nauwelaers, Rene Wintjes, 2008). However it ignores the role of innovations which are not created by the results of R&D.

In the globalization the rise of innovations, political stimulation of scientific researches and development become one of the most important factors that influence economic status and the prospects of economic development (Melnikas, 2008, Dzemyda, Melnikas, 2009). Efficient combination of innovations and human resource strategies is crucial for emerging economies, where successful catch-up is mainly driven by innovation (Le Bas, Laužikas, 2009). In order to achieve this goal, there is

need to implement efficient and purposeful policy on European, national and regional levels, that is interconnected with micro motives and attitudes of society. This makes a lot of challenges, because social, economical and cultural conditions are different in various nations and countries, and needs more specific decisions. Object of research is the dichotomy between the perception of innovations in the European policy and society (in this case, societies of Lithuania and Romania). The aim of the research is to evaluate European Union policy from the scope of population's perception of innovations in Lithuania and Romania.

The EU Policy is evaluated by using path model as the logical extension of multiple regression models, which belong to structural equation models' family (Hayduk and Pazderka-Robinson, 2007; Chen, Bollen, et al., 2001; Dilalla, 2000; Freeman, 2007). The data used in the research is from "Eurobarometer 63.4 survey European Union Enlargement, the European Constitution, Economic Challenges, Innovative Products and Services" (2005) survey that represents attitudes towards innovations of population in stable economy (Svetikas and Dzemyda, 2009, Rakauskienė and Krinickienė, 2009).

2. Scientific Research Area and Its Influence to Innovations in European Union

The scientific research and innovations in European Union are observed by Dragan (2009), Dzemyda (2009), Dzemyda and Melnikas (2009).

The board of results on innovation at European level (European Innovation Scoreboard, EIS) 2009 shows that, prior to the financial crisis, the European Union achieved important progress in the field of innovation. The relative discrepancy compared with the US and Japan in the innovation field decreased, especially due to the significant achievements of the new member states, such as Cyprus, Romania and Bulgaria. European Union achieved progress especially in the field of human resources and funds available for innovation. However the investments of companies in innovation remain relatively reduced compared to the situation in US and Japan. The 2009's report on science, technology and competitiveness also offers a deep analysis of trends in the field of public and private research and development, technological performance and progress achieved in putting the European research area into operation.

"A period of crisis is not the right time to give up the investments in research and innovation. They are vital if Europe wants to get through the economical crisis even stronger and to approach the challenge of climate changes and globalization," pointed out Günter Verheugen, vice-president, responsible for policy regarding the enterprises and industry.

The European countries are divided in 4 groups of innovation ranking, and all countries improved the performances, even though the progress rate varies:

1) Leaders in innovation (ranking far over the EU average): Switzerland, Sweden, Finland, Germany, Denmark, and the UK; out of them, Switzerland and Germany have the highest rate of improving the performance.

2) Innovation followers (over the EU level): Austria, Ireland, Luxembourg, Belgium, France, Netherlands, Estonia, Cyprus, Iceland, Slovenia.

3) Moderate innovators (below the EU average): Czech Republic, Norway, Spain, Portugal, Greece, Italy, Lithuania, Hungary, Malta, Poland, Slovakia.

4) Low innovative (far below the EU average): Croatia, Serbia, Romania, Latvia, Bulgaria and Turkey; these countries are in process of covering the gaps, Bulgaria and Romania having the highest rate of improving the performances.

The analysis of information at EU level shows the important progress that has been achieved, both in absolute terms (compared with the level of 5 years ago) and in comparison with the US and Japan.

Comparison with a larger group of countries shows that EU also had a relatively good evolution in relation to the emergent economies. Progress was achieved in the field of human resources involved in the innovation process (licentiates, colleges), access to the broadband internet, and availability of risk capital. Nevertheless weaknesses continue to exist with regards to private investments, where the EU comes after the US and Japan, from the point of view of spending for research, development and informatics. Also, despite the report showing the important role of the non-technological innovation, the spending of EU companies for such innovation activities (professional training, design, marketing, new equipment) decreased.

EU has an extraordinary innovation potential. Europe has a long standing tradition of break-through inventions. It has laid the basis for one of the largest single markets in the world, where innovative products and services can be commercialized on a large scale. It has also a tradition of a strong and responsible public sector, which should be capitalized on.

The communication from the European Commission, "Putting knowledge into practice: an innovation strategy extended for EU", mentions that the agreement on financial framework 2007–2013, including cohesion policy, the 7th Research and Development Framework Programme and the Competitiveness and Innovation Framework Programme are significant financial packages innovation friendly.

The Commission's communication "More research and innovation" of Oct. 2005, sets out a programme of 19 fields of action for both community and the member states, which are being implemented as planned. The member states are taking action in favor of innovation in the framework of the National Reform Programmes, based on the integrated guidelines of the renewed Lisbon Strategy for Growth and Jobs. The European Trend Chart on innovation has given a clear picture of the European innovation performance and of the national innovation systems of the EU member states and of their strengths and weaknesses. It enables progress to be closely monitored.

Despite this already strong policy focus on innovation, the EU deficiencies have not been sufficiently tackled, and its economy has not yet become the comprehensively innovative economy that it needs to be.

The report on “Creating an innovative Europe” (the Aho report) identified the main reasons explaining why this potential has so far not been fully exploited and called for urgent action “before it is too late.”

It identified the need to make the business environment more innovation-friendly as a core concern.

The Commission is convinced that even more is needed—Europe has to become a truly knowledge based and innovation-friendly society where innovation is not feared by the public but welcomed, is not hindered but encouraged, and where it is part of the core societal values and understood to work for the benefit of all its citizens. That is why the European Council called on the European Commission to present a broad based innovation strategy for Europe that translates the investments in knowledge into products and services.

This Communication COM (2006) 502 final presents such a strategy, in particular by responding to the recommendations contained in the Aho report. It presents a framework to take innovation forward bringing together different policy areas which have a bearing on innovation. It is intended to frame policy discussions on innovation at national and European levels. It outlines the most important planned or on-going initiatives, identifies new areas for action, and in particular produces a more focused strategy to facilitate the creation and marketing of new innovative products and services in promising areas—the “lead markets.”

To implement this broad agenda, the Communication does not propose to create new structures, but instead it builds on the existing legal and institutional framework of the renewed Lisbon Partnership for Growth and Jobs, which has already established a political platform for partnership between the member states and the Commission.

The member states must be ready to invest in anticipating and accompanying structural change. This requires in particular a reallocation of resources to education, Cybernetics and Information Technology, research and to the creation of high value jobs and growth.

The new EU Financial Framework for the period 2007–2013 is a first step in this direction. The same change of priorities needs to be seen at national levels.

The EU can only become comprehensively innovative if all actors become involved and in particular if there is a market demand for innovative products. This broad strategy needs to engage all parties—business, public sector, and consumers. This is because the innovation process involves not only the business sector, but also public authorities at national, regional and local level, civil society, organizations, trade unions and consumers.

Such a wide partnership for innovation will create a virtuous circle, where supply of new ideas and demand for new solutions both push and pull innovation. Innovation depends on a strong demand from consumers and citizens for new and innovative products and services. Therefore, besides creating the optimal framework and possibilities to innovate, there must be an innovative friendly market and demand for outputs. This, in particular requires consumer trust and confidence in these products and services not least in their (demonstrable) safety. Consumer confidence in un-

known products and services depends in part on the knowledge that robust systems of consumer protection exist. Markets where consumer confidence is high are also easier for new entrants with innovative products.

3. Methodological Issues Related to Assessing the Innovations

In order to implement successful measures of innovation policy in EU, at first we must be able to measure the outcome of these measures. Though the theoretical structure of the term “innovation” is universally accepted and there is no radically different interpretations related to this subject. However, a number of methodological problems related to the measurement of values of innovation especially at regional or national level arise. And what is more, the measurement of regional or national innovative potential is increasingly becoming more popular along academics and politicians, because it can give for them guidelines for choosing one or other innovation policy. Innovation is complex process. Innovation process can be seen as interaction of micro and macro factors, the macro-structure leads to micro-dynamics and vice versa, the macro structure is built around micro-processes. In other words, innovativeness of firms (micro level) determines regional or national parameters of innovation and, on the contrary, the education of country’s population, innovation-friendly environment or the public policy (macro level) has an impact on innovations processes in the corporations. Accordingly to this, the choice of priorities (micro or macro) determines the research strategy of innovation, which can be divided into two dimensions. Wide dimension prefers macro-elements (it includes not only the creation of innovation, but also its distribution and diffusion), and narrow dimension prefers micro-elements (innovation in hardware and software are equated to inventions). Other cause of methodological problems is that creation, development and use of innovations include not only tangible processes, which have numerical representation, but include also disparate, intangible processes. In many cases, these methodological issues are preceded due to complexity of innovation as object of research. The innovation and it’s creation encompass tangible assets: information, communication, etc., but innovations also include intangible assets: patents, database, R&D progress and so on. This duality leads to a large variety of methods used for the research of innovations, because there is no single approach, that could encompass both elements which can be numerically evaluated and cannot be.

Table 1. Tangible and intangible assets according to (Rose, Shipp, 2009)

Tangible Assets	Intangible Assets
Information and communications	Patents
Technology infrastructure	Databases
Production materials	R&D progress
Production machinery and facilities	Organizational processes
	Knowledge and skills of labour force

To sum up innovation is so a complex process, that it cannot be easily reduced to measurable elements (e.g., R&D dollars spent; number or value of patents obtained). Nor is it linear. Instead, it is often iterative—the outputs of early activities become the inputs for later processes. Innovation is also not a linear combination of component factors or limited within the boundaries of firms.

Innovations were begun to be measured after the Second World War. Measurement of innovation can be divided into a several generations of innovation measuring indicators.

Table 2. Generations of innovation indicators
(Source: Egils Milbergs, Nicholas Vonortas, 2006)

First Generation Input Indicators (1950s-60s)	Second Generation Output indicators (1970s-80s)	Third Generation Innovation Indicators (1990s)	Fourth Generation Process Indicators (2000s plus emerging focus)
<ul style="list-style-type: none"> • R&D expenditures • S&T personnel • Capital • Tech intensity 	<ul style="list-style-type: none"> • Patents • Publications • Products • Quality change 	<ul style="list-style-type: none"> • Innovation surveys • Indexing • Benchmarking innovation capacity 	<ul style="list-style-type: none"> • Knowledge • Intangibles • Networks • Demand • Clusters • Management techniques • Risk/return • System dynamics

The first generation was characterized by the fact that innovation processes have been perceived as a linear process. In view of the linear nature of innovation processes, the main objects of innovation research were inputs, such as—R&D investment, education expenditure, capital costs, research staff, university graduates, technological intensity, and so on.

The second generation added to the input indicators intermediate outputs created as result of activities of S&T. Typical measurement examples of this generation are patents, scientific publications, new products or processes, calculations, high-tech trade.

The third generation focused on innovation indicators and indices that are calculated by means of surveys and integration of publicly available information. The main objective is to compare and to rank States by their abilities to create innovations. The main obstacles at present are that the validity of international data for comparing states and incorporation of service sectoral innovations into polls. In other words, these surveys showed that R&D and innovations are not identical; however it did not bring any changes specific political instruments directed towards encouragement of innovations. This is partly due to the fact that the questionnaire should be short and simple to understand, so they do not provide the necessary depth of information to policy makers.

Relative infant fourth generation of innovative methods of measurement encompasses these new spheres (Susan Rose, Stephanie Shipp, 2009):

- **Knowledge indicators.** The knowledge is more important because it paved the way for creation, development and diffusion of these mentioned elements. However the measurement of multi-layered concept such as knowledge requires sophisticated, composite indicators. Such indicators may include composite knowledge investment indicators and composite performance indicators.
- **Networks.** The striking feature of modern innovations is the fact that hardly any organization can innovate alone. Most innovations include development of a multitude of organizations. This is particularly true in innovations which require a lot of knowledge and complex technologies. Such networks work not only at regional but also at national or even at global level
- **Conditions for innovation.** Economic demand, public policy environment, infrastructure conditions, social attitudes and cultural factors are critical for successful innovation. What is called for here is building systemic innovation metrics that capture the context in which organizations form and match expectations and capabilities to innovate. To the extent that they exist, these 4th generation metrics of the knowledge based networked economy remain ad hoc and are, thus, of limited analytical value. They can be improved only through a concerted, coordinated and internationally visible effort. The type of research in this article is from 4th generation. The analysis will try to explore conditions for innovation in both Lithuania and Romania; accomplished surveys in the field of population's perception of innovations in Lithuania and Romania will show social attitudes towards innovations.

4. Possibilities of Data Analysis to Evaluate Influence of Innovations

The main aim of research is to explore theoretical relationships between social attitudes towards innovation and to make comparative study between Lithuania and Romania. Relationships between attraction, purchase and trust of innovation on the one side and life quality and financial situation of people in Lithuania and Romania on the other side are analyzed. The example shows the implication possibilities of structural equation modeling in innovation policy research.

To evaluate EU Policy using survey data in the article is chosen path model as the logical extension of multiple regression models. Path analysis belongs for structural equation models' family, that aims systemize the representation of causal effects, and the unavoidable implications of those effects (Hayduk and Pazderka-Robinson, 2007). Thus path models require the analysis of several multiple regression equations using observed variables (Schumacker, Lomax, 2004). Path analysis could be used as a method for studying the direct and indirect effects of variables (Wright, 1960). Path analysis doesn't study causes, but it tests theoretical relationships only. The model helps to make experimental research of certain variables to assess the change in other variables that are more closely to causation.

The hypothetical Path model is specified in Fig. 1.

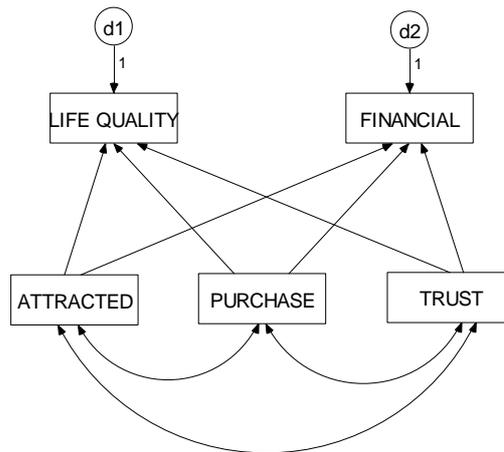


Fig. 1. Hypotetical teorethical path model

The variables defined in Table 3 shows that the observed variables such as “Life Quality” and “Financial” are exogenous. The observed variables “Attracted”, “Purchase” and “Trust” are endogenous, correlations between these variables are evaluated. Recursive (nonreciprocal) relation between exogenous and endogenous variables is evaluated as well.

Table 3. Variables and their definition

Variable name	Definition
Life Quality	Responses to question, that evaluates quality of life
Financial	Responses to question, that evaluates financial situation
Attracted	Responses to question, that evaluates to what extent respondents are attracted towards innovative products or services, in other words new or improved products or services
Purchase	Responses to question, that evaluates in general person’s (dis)inclination to purchase innovative products or services comparing with the attitudes of his/her family and friends
Trust	Response to question, that evaluates in general person’s (un)willingness to stay with product or service they are used to, or to try innovative new product or service in place of older one.

The research was based on the official data presented by “Eurobarometer 63.4 European Union Enlargement, the European Constitution, Economic Challenges, Innovative Products and Services” (May-June 2005) survey. This survey is chosen for research because this period is considered as case of stabile economy in Lithuania

(Svetikas and Dzemyda, 2009, Rakauskienė and Krinickienė, 2009). The data of Romania (1004 cases) and Lithuania (1002) is analyzed.

Reliability test for Romanian and Lithuanian data is sufficient. Cronbach's coefficient Alpha for Lithuanian data is 0,589 and for Romanian—0,673 is considered adequate. Measurement errors (d1 and d2) in observed exogenous variables are evaluated.

Version 5 of Amos (Analysis of Moment Structures; Arbuckle, 2003) is used for the research.

5. Approach to Evaluate European Union Policy in case of Lithuania and Romania

During the research we explored theoretical relationships between attraction, purchase and trust of innovation and life quality and financial situation of people in Lithuania and Romania. The study shows social attitudes towards innovations in Lithuania and Romania. Results of Lithuania are presented in Fig. 2 and Romanian results are showed in Fig. 3.

Results of Lithuania shows, that there is statistical relationship between attraction and purchase of innovation, but relationships ATTRACTED \leftrightarrow TRUST and PURCHASE \leftrightarrow TRUST are weak, that implies that Lithuanian society not consumes innovative products or services so much. Besides statistical relationship between attraction and trust of innovation is negative, that shows, that people in Lithuania not always trust innovative products or services even if they are attracted to them. These results are different from Romania, where statistical relationships ATTRACTED \leftrightarrow PURCHASE, ATTRACTED \leftrightarrow TRUST and PURCHASE \leftrightarrow TRUST are much more stronger. That implies, that Romania society consumes innovative products and services much more than Lithuanian.

Theoretical recursive relations between attraction, purchase, trust of innovative products and services and life quality and financial situation shows attitude differences to innovations between Romania and Lithuania. Recursive relations between variables ATTRACTED \rightarrow LIFE QUALITY, ATTRACTED \rightarrow FINANCIAL, TRUST \rightarrow LIFE QUALITY and TRUST \rightarrow FINANCIAL are almost same in Lithuania and Romania, that shows that people, who are more attracted towards innovations and trust innovative products and services, statistically have better life quality and financial situation in both countries. But recursive relations between variables PURCHASE \rightarrow LIFE QUALITY and PURCHASE \rightarrow FINANCIAL are different in Lithuania and Romania. Growth model of Lithuania shows, that people, who tend to purchase innovative products and services, have better life quality and financial situation, however it is different in Romania according its growth model.

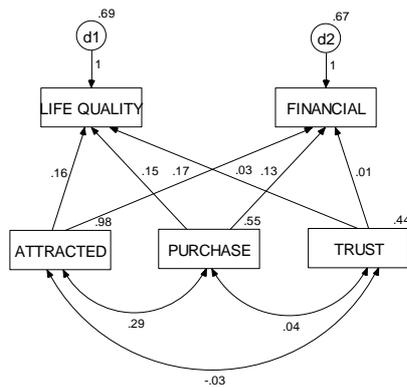


Fig. 2. Results: growth model for Lithuania

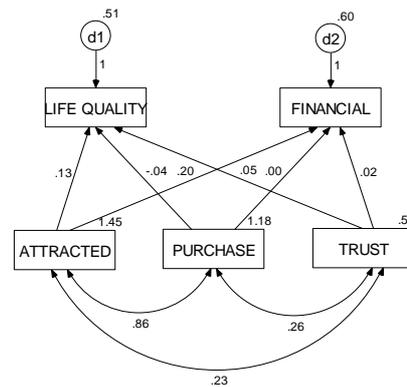


Fig. 3. Results: growth model for Romania

Results of study (eg. measurement errors in observed variables d1 and d2) show different attitudes towards innovative products and services between Romanian and Lithuanian populations. These differences could be influenced not only by social and economical circumstances, but also it can be caused by historical, political, geographical and other conditions. This implies horizons for further studies of national innovation systems, poses a number of specific characteristics regarding the national institutes, featured of historical development, transformation and self-organizing under the control of the state (Uskelenova, 2009).

Conclusions

Theoretical relationships between attraction, purchase and trust of innovation and life quality and financial situation of people in Lithuania and Romania let explore European Union policy for countries, the innovativeness of which are below EU average. The study shows, that local consumption of innovative products and services not necessary leads to better innovativeness of country.

Commission of European Union is convinced that stimulus of innovativeness is innovation-friendly society. As our research showed, that citizens of innovatively weaker nations as Lithuania and Romania have very innovation-friendly attitude, but their countries still lag behind more developed countries of European Union. Positive social attitude towards innovation and consumption of innovative products and may not be a pivot that could improve nation's innovativeness, because citizens of Lithuania and Romania can choose and purchase various innovative products and services from foreign countries (including European Union states that have higher innovativeness level than Lithuania and Romania). According to this national innovative industry do not get proper stimulus from their population for producing more innovative products despite the fact that the population has positive attitudes. In respect to that European Union authorities and member-states with lower innovative

indexes should have very purposeful and consistent innovation policy; because of their technological lag the free market would not solve their problems related with innovativeness or, to be precise, lack of innovativeness. This hypothesis should be researched in further studies using other data.

The research is an example of implication of structural equation modeling in innovation policy research and could be used for further studies.

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EUROPOS SĄJUNGOS INOVACIJŲ POLITIKOS ĮTAKOS ŠALIŲ NARIŲ EKONOMIKOS AUGIMUI VERTINIMO METODAS

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Santrauka. Nagrinėjami keli klausimai, susiję su inovacijų plėtote Europos Sąjungoje. Visų pirma analizuojami Europos Sąjungos dokumentai ir Europos švieslentė. Atlikus analizę nustatytas didžiulis inovacinis atotrūkis tarp Europos Sąjungos valstybių narių. ES institucijos mano inovacijas esant galingu įrankiu, galinčiu padidinti Europos Sąjungos šalių ekonominę lygybę. Antroje straipsnio dalyje apžvelgiami metodologiniai klausimai, kylantys atliekant inovacijų tyrimus. Pagrindinė problema, susijusi su inovacijų matavimu, yra tai, kad inovaci-

jos apima tiek materialius, tiek nematerialius elementus. Moksliniame tyrime taikomi ketvirtosios kartos inovacijų matavimo metodai, kuriais siekiama įvertinti Europos Sąjungos inovacijų politiką pagal Lietuvos ir Rumunijos gyventojų nuostatas, inovacijas. Atlikta lyginamoji Lietuvos ir Rumunijos studija. Tyrimas atskleidžia visuomenės požiūrį į inovacijas, jų ryšį su gyvenimo kokybe bei finansine padėtimi bei rodo, kad vietinis novatoriškų produktų ir paslaugų vartojimas nebūtinai veda prie šalies inovatyvumo.

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