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Foresight methods for smart specialisation strategy development in Lithuania

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ABSTRACT

This paper presents the methodological approach and first results of the ongoing national level foresight process organised in Lithuania in the context of preparing the smart specialisation strategy and defining the national research and innovation priorities. The main objective is not to determine where to invest but how to help agents to discover where to invest in a decentralised and bottom-up logic. The methodology accepted in Lithuania departs from the traditional approach to priority setting focused on identification of research fields or economy sectors, and builds on the concepts of long term challenges and critical technologies. Choosing challenge-based priorities allows to better develop synergies and integrated policies, thus reducing fragmentation. A mixed qualitative and quantitative method approach is applied, including the expert panels, surveys, statistical and bibliometrical analysis, roadmaps, and analytical studies on the emerging trends and long term challenges.

1. Introduction

The existence of a national strategy for smart specialisation (S3) is an ex ante conditionality for the use of the European Union (EU) Structural Funds from 2014 to 2020. The underlying rationale is that by concentrating resources in research and innovation and linking them to a limited number of priority economic areas, countries can become and remain competitive in the global economy. However, S3 that ignores country-specific economic and institutional context is bound to fail. In case of Lithuania this context to consider is characteristic for a country who is exploiting the advantages of the efficiency or factor driven phase of economic development, but at the same time aspiring to make a further shift towards the competitiveness based on knowledge and innovation. Considering this, the mid- to long-term challenge for Lithuania is to promote the structural change of economy by providing transformation agenda for diversification of existing sectors and transition to new activities. S3 can provide a suitable platform for that transformation, as it is fundamentally based on a process of entrepreneurial discovery — an 'entrepreneurial selection' of market opportunities or a 'self-discovery process' (Hausmann & Rodrik, 2013). The objective is not about telling the innovation system actors what the right specialisations are but accompanying emerging trends and improving coordination by providing the necessary public goods and creating additional incentives at critical bottlenecks to help the new activity to grow. Therefore, the outcome of the process is a structural evolution of the whole economy (Foray, 2011).

At present Lithuania has a number of basic weaknesses present in its innovation system. The growth experienced so far cannot be considered as knowledge based. The most prominent sectors in economy are traditional ones accounting for the largest share in value added, employment and leading in the Lithuanian exports. However, to sustain the competitiveness they face the need of upgrading. At the same time, the innovation potential in the Lithuanian economy lies within emerging high technology

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sectors like biotechnology and pharmaceuticals, which are still rather small with little to contribute to economy in terms of value added and employment. The majority of overall modest research and development (R&D) efforts in Lithuania are funded by the public sector and carried out by public research institutions. The cooperation between industry and public research organisations has remained at a very low level and success stories on the technology transfer or commercialisation of public R&D are rare. There is fragmentation of R&D and innovation (R&I) policy priorities, programmes, funds and institutions, and failure to leverage different funds and create synergies between measures. Efforts to concentrate funds and create connections, such as the 'science valleys' or clusters, have so far been able to deliver only very limited effect. This is a critical issue, considering the policy mixes planned for the implementation of S3. Governance of R&I policy is non-systemic, characterised by limited synergies. It lacks cross-departmental cooperation and is mirrored by ineffective and process-oriented policy implementation. As the implementation of S3 is largely a governance challenge, those issues need attention and action already in the S3 design phase.

In this context one might argue whether Lithuania is ready for the adoption of the concept as sophisticated and demanding as the smart specialisation. However, development of S3 has a strong potential to generate and catalyse systemic changes in the Lithuanian R&I arena in many respects. First, the S3 turns the R&I policy's centre of gravity to economy and society and their long term challenges compared to the previous technology-centred and linear understanding of innovation. Second, it enforces to make selections, set clear and consistent priorities and mobilise resources across different administrative 'pockets' both at national and transnational levels, thus reducing fragmentation. Third, it can considerably improve the policy making and implementation practice and set new requirements for the policy governance.

Foresight has been promoted as a tool for enhancing innovation and change at various levels, in comparison to incremental improvements and inertia (Patton, 2005). The general goal is to create awareness about the external environment and to enable strategies to react to those changes (Patton, 2005). Foresight thus aims at identifying discontinuities, trends, emerging technologies and future opportunities in promising areas of strategic research, and providing early warning about potential threats to support planning and shape strategy (Martin, 1995). Foresight can offer vital input for 'quantum leap' in R&I policymaking. It stresses the possibility of different futures, as opposed to the assumption that there is an already given, pre-determined future, and hence highlights the opportunity of shaping the future. It can enhance flexibility in policy making, broaden perspectives, and encourage thinking outside the box. In other words, foresight can serve as a crucial part of an early warning system, and it can be seen as an instrument for an adaptive, 'learning society' (Havas, 2003). Over time, there has been a shift from environmental scanning and trend extrapolation to exploring possible changes and shaping the future with the help of participatory methods (Daheim & Uerz, 2008). It has been argued (Blackman & Henderson, 2004) that the dominant logic in organisations and/or policies hinders the acknowledgement of change and acceptance of alternative development paths. The task of proactive participatory exercises, therefore, is to challenge basic assumptions and the underlying mental models that are used to build consistent expectations about the future (Blackman & Henderson, 2004). Foresight is a suitable approach for defining the Lithuanian R&I priorities and developing the smart specialisation strategy as it combines participatory process elements with systematic future exploration (Weber, 2012). First, there is a clear need to 'shake' or reshape the system, diversify into new development paths and find new routes to cope with existing problems. Quite a few pressures — especially the need to build linkages and facilitate cooperation, change attitudes and norms, develop new strategies and solutions, and balance budgets — are now pressing the decision makers. Second, participation is a key element of foresight. Involvement of key stakeholders early in the process can ensure that the insight creation is followed by actions (Salo & Cuhls, 2003).

In spring 2013, the Lithuanian Ministry of Education and Science and Higher Education Monitoring and Analysis Centre (MOSTA) launched a foresight-type process for identifying the smart specialisation priorities. MOSTA has got a mandate for coordinating the respective foresight process. An International Independent Expert Group consisting of the national and international experts, implementing agencies and social-economic partners was formed in March 2013 to assess the current R&I potential in Lithuania and to provide recommendations on the priorities for smart specialisation and their further development until 2020.

This paper:

- Discusses the context of a country marked with socialist past and economy transition and explains the methodological approach adopted for selection of the national smart specialisation priorities for State investments in R&D and innovation;
- Presents the first stage results of the ongoing foresight process;
- Discusses further steps in finalising the process and implementing the smart specialisation priorities.

2. Methodological approach

2.1. S3 priorities: principles, tensions and national context

The ex ante conditionality (European Commission) and Guide to Research and Innovation Strategies for Smart Specialisation (Foray et al., 2012) sets out several key requirements regulating the process and outcomes of identification of smart specialisation priorities. It is expected that resources should be concentrated on a limited number of well-defined priorities. This requires tough choices on the basis of own strengths and international specialisation (Foray et al., 2012). The selected priorities should be based on a shared vision built during wide consultation process. It should include a wide range of entrepreneurs, researchers, social partners, etc. Priority setting should rely on the logic of entrepreneurial discovery of likely market opportunities (David et al., 2013). It concerns experimentation and discovery of domains of specialisation given the existing productive assets. The discovery process is expected to focus on embedded national/regional strengths and fostering of related variety, i.e. building on the existing skills, assets and capabilities to develop new growth paths, sectors, and modernisation of 'traditional' industries (Asheim et al., 2011). External linkages are also important, i.e. it is expected that national priorities should constitute elements

of a strategy of wider EU regions, for example the Baltic Sea Region. The expected outcome of the process is much more than a 'simple' technological innovation but rather a structural evolution of the whole economy — the transition from one old, perhaps declining activities to the new ones offering superior growth prospects (Foray, 2011).

Smart specialisation is an excellent example of a theoretical concept translated into policy. As one could expect this inevitably implies at least several paradoxes and conundrums. First, as a theoretical concept it enforces entrepreneurial discovery — a lengthy iterative process. The European Commission, however, imposed strict deadlines on the Member States to deliver the priorities. Moreover, while entrepreneurial discovery suggests that this is a continuous process, this goes counter to the logic of programming Structural Assistance funds. It implies that priorities should be set at the beginning of the programming period and implemented during the remaining 7 years.

The second conundrum refers to inter-regional cooperation and specialisations. Regional concentration on a few priorities that are part of an integrated broader regional strategy in theory should lead to full utilisation of comparative advantage, economies of scale, critical mass, etc. Such strategy at a national level has already proved its benefits, since it induces higher efficiency at system level, while the risks associated with specialisations of each region are offset by the central government that acts as 'insurance device' should the regional specialisations fail. However, if this idea is applied to European regions (e.g. the Baltic Sea region, Danube region) consisting of small states classified as NUTS 2 region,[3] the idea of international (inter-regional) cooperation loses political feasibility. Concentration of resources on a few priorities implies major risks for a country. As long as there is no way to pool these risks (i.e. the EU does not have a single fiscal, regional development, research and innovation policy), the insurance mechanism for small countries is absent. Hence, the logic of 'not putting all eggs in one basket' is likely to prevail.

Furthermore, the proposed approach to setting priorities implies major challenges to countries marked with socialist past and economic transition. While below we discuss challenges specific to the Lithuanian context, it is likely that they could be also relevant to other post-communist Central and Eastern European countries. First, since the early 90s Lithuanian policies focused on improving framework conditions and implementation of horizontal policies. These policies are deeply rooted in the experiences of early transition that relied on the so called Washington consensus (Williamson, 1990) regarding the role of the state in economy. More specifically, the consensus among policy makers between 1990 and mid 2000s was that: a) the market will reallocate resources to the most productive and competitive sectors; b) any Government intervention favouring specific economic activities or sectors distorts the market; c) long term economic planning efforts are remnants of the soviet past and therefore should be abandoned. Hence, in line with the advice from international financial institutions, policy efforts until the turn of the century focused on privatisation of state owned assets and liberalisation of the market.

Accession to the EU in 2004 favoured introduction of 'strategic planning' and 'priority setting' to the policy discourse. Furthermore, access to the EU Structural funds led to considerable increase in public R&I funding. While unsurprisingly considerable funding was based on excellence, substantial attempts were also made to define and fund sectoral R&I priorities. These efforts, however, were very fragmented as different ministries and funding institutions sought to pursue 'own' priority fields. As a result the last decade witnessed proliferation of strategies and priorities that eventually covered all economic sectors and research fields.

Second, consensus-based approach to decision making is not supported by prevalent policy-making styles. Since the start of the EU accession negotiations, considerable efforts have been made to increase transparency in public funding decisions. Large political discretion to allocate funds and shady lobbying efforts of interested parties were perceived as the main challenges to transparency. As a result the last decade witnessed development of systems for allocation of public funds that rely on quantitative indicators and/or judgement of external independent experts. Thus the idea of wide involvement of stakeholders in setting of priorities (that will guide further public funding) runs counter to the efforts to date.

Lastly, entrepreneurial discovery encourages experimentation and risk-taking. Some of the new economic activities identified as priorities are likely to fail (otherwise one could hardly speak of experimentation). This, however, goes counter to Weberian post-socialist (Nakrošis & Martinaitis, 2011) administrative culture that emphasise legality and legitimacy of decisions. Here failure to meet agreed targets is strongly linked with lack of competence or outright corruption. This also challenges the monitoring framework that is supposed to monitor (and help accounting for) outputs and results. Hence, encouraging risk taking in risk averse public administrations poses a major challenge for smart specialisation.

The above discussed challenges had important implications for the S3 priority setting exercise. First, due to the legacies of mainstream economic thinking of the 90s, institutionalised system for research — industry deliberations on R&I priorities is virtually absent. Second, experiences of the 2000s with vast number of strategies and priorities imply considerable scepticism towards yet another priority setting exercise. Lastly, involvement of stakeholders runs counter to the widely perceived ideal of objective decisions and highlights transparency issues.

2.2. Methodological choices

Considering the challenges and tensions discussed above, the process for identification of S3 priorities adopted four methodological solutions: multi-staged process, combination of analytical and participatory methods, focus on long term challenges and trends, and outcome orientation. They are discussed on more length below.

2.2.1. Multi-staged process

Running a continuous foresight exercise (starting with the diagnosis phase and ending with specific recommendations

[3] The Nomenclature of Territorial Units for Statistics, (NUTS, for the French *nomenclature d'unités territoriales statistiques*), is a geocode standard for referencing the administrative divisions of countries for statistical purposes, developed by the European Union.

regarding the priorities) would represent a straightforward approach to identification of the S3 priorities. This approach was not feasible due to three of the above discussed tensions. First, due to past legacies (absence of institutions for deliberations and priority setting, high administrative fragmentation, previous focus on improving 'framework' conditions) there was a need to build a consensus on the overall approach to setting S3 priorities and to set-up formal and informal institutions necessary for the process. Second, due to high stakes involved in setting S3 priorities and high anticipated pressures from interested groups the need for transparency was overwhelming. Hence, instead of designing the exercise as a single process, a more incremental and adaptive approach was chosen. It consisted of three stages, each designed as a separate process. Outcomes of each stage had to be verified by the external stakeholders and formally approved by the policymakers. This was seen as a precondition for building consensus regarding the process and its outcomes among participating and non-participating stakeholders. Lastly, with the view of structuring the interactions among stakeholders and minimising high risks related to narrow specialisation, it was decided that there was a need to firstly build consensus on broader priority areas and only then discuss specific priorities within these areas.

A three-staged national foresight approach as adopted (see Fig. 1). Each stage could be viewed as a separate project, since: a) at the start of the exercise there was a lack of policy commitment for the whole process, hence each stage could proceed subject to satisfactory results achieved at previous stages; b) while Stage 0 included drafting of guidelines for the whole process, each stage revised the initial approach taking into consideration the outcomes of the previous stage.

The Stage 0 was devoted for scoping — developing and discussing the methodology, awareness-raising, building consensus on the methodological choices, including the definition of 'priorities' and 'priority areas', securing the funding and constructing a management system consisting of the coordinating committee (public officials from the key ministries), administrative body (MOSTA), and the implementing bodies (the International Independent Experts Group as well as two separate consortiums of analysts and expert groups' facilitators contracted through a public procurement procedure). The scoping stage was extremely important due to the parliamentary elections in October 2012 that led to the change in Lithuania's government. The new centre-left Government was formed in December 2012 and replaced the previous centre-right Government. A success in the new Government supporting the national foresight idea was a result of the targeted awareness

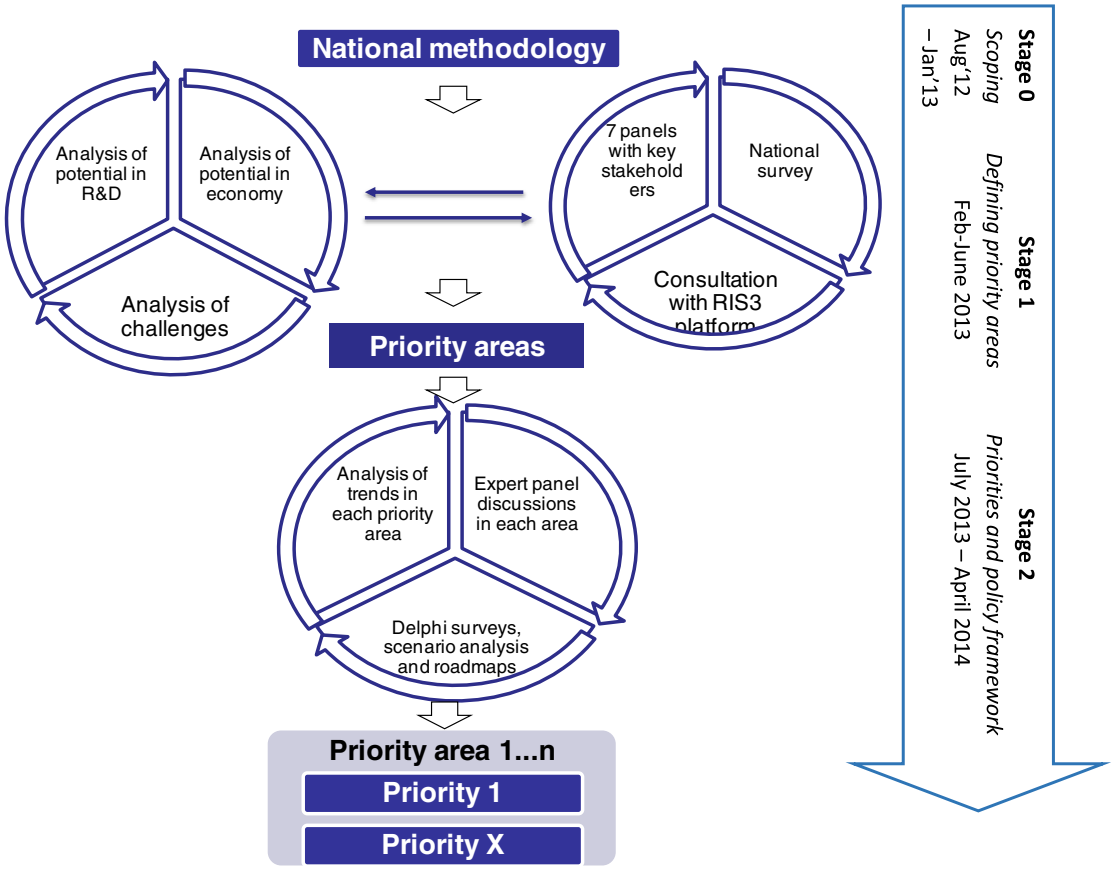

Fig. 1. Stage and method mix adopted in the Lithuanian foresight process.

building activities that were launched before the Government was formed and had created consensus in the administration on the need for this process. However, changes in the Government resulted in a delay of the launch of Stage 1, and it was one of the reasons why Stage 1 was much shorter than previously planned.

The Stage 1 was aimed at identifying the broader priority areas, and was based on the analyses of the long-term national challenges, the current research and economy potential and discussing it with the key stakeholders and representatives from research and business in the 7 expert panel discussions.

After the priority areas were approved by the Government, the Stage 2 was launched for defining the specific priorities within each priority area. This process involves a more detailed analysis of trends and challenges in each of the priority areas, followed by discussions of expert groups comprised of business and research representatives in each priority area, scenario analyses, surveys and roadmaps. The roadmaps and expert discussions should feed into specific policy mixes designed to implement the priorities.

2.2.2. Combination of analytical and participatory methods

Choice of methods was guided by two concerns. First, with the view of ensuring transparency of the process it was decided that all likely and unlikely stakeholders should be involved. This was seen as essential for counterbalancing potential influence of institutionalised interested parties. Second, a range of analytical methods were introduced so as to provide evidence for the discussions of stakeholders and fully exploit the opportunities provided by administrative systems and culture that emphasises 'objective' decisions. Furthermore, a mixed-methods approach seemed adequate to exploit the benefits and minimize the risks of each qualitative and quantitative method (see Table 1).

2.2.3. Long term challenges and trends

One of the risks of investing in new economic activities is that the markets for such innovations are absent, time-horizon is medium-long and success is not certain. Hence, traditional methods for estimating economic feasibility of such activities fail. To tackle this problem the foresight exercise in Lithuania focused on long term challenges and trends. The main assumption was that whenever there is a challenge or problem, market demand is likely to follow. This does not imply that Lithuania should aim tackling all global or regional issues. Instead, the largest gains could be sought when focusing on challenges or opportunities that can be adequately addressed with a current R&D base. Similarly, Lithuanian R&D has developed capacities in a broad range of areas. This does not imply that all of them should be further developed. Instead, smart specialisation implies making use of capacities that are the most relevant in the face of emerging challenges. Accordingly, Stage 1 and Stage 2 involved mapping of challenges with competitive strategies of Lithuanian industries and available R&D potential in public and private sectors.

2.2.4. Outcome orientation

A traditional approach to priority setting in Lithuania has focused on identification of research fields or R&D sectors. ICT, biotechnology, civil engineering or agriculture are all examples of such sector-based approach. However, the focus on sectors has a number of drawbacks.

Table 1
Mixed methods approach.

Methods	Strengths	Risks	Risk management
Qualitative, e.g.: - Expert panels; - Scenarios; - roadmaps; - literature review (structured meta-analysis, horizon scanning); - Web-based crowdsourcing ('ideas competition').	- Easier to identify and analyse qualitative indicators, phenomena, processes that are difficult to quantify; - Inclusion of experts creates ownership of results and creates networks; - Creative methods, e.g. scenarios help breaking 'out of the box' and noticing 'weak signs'.	- Limited availability of thematic experts in a small country; they are typically very busy and cannot attend meetings; conflicts of interest; - Human factor, subjectivity, over-rating or under-rating some factors. - Managing expert panels requires good methodological and moderating skills: the 'authorities' or certain interest groups can capture the discussion and 'occupy' the final result. - Limited availability of high quality local material for meta-analysis.	- Professional moderators and facilitators; - Public and private sector balance ensured; - Methodological guidelines for experts, as well as experts groups' discussion material; - Semi-quantitative methods are applied to analyse opinions of broader target groups (see below). - All materials bilingual (Lithuanian and English, at least in the Stage 1); meta-analysis and horizon scanning uses international sources. Limitation: foreign methodological expertise could have been very helpful, but was not invoked due to the limited budget.
Quantitative/semi-quantitative: - Statistical and bibliometrical analysis; - Multiple criteria analysis and critical technologies; - Expert survey (Stage 1) and Delphi surveys (Stage 2).	- Reliability: uses valid and reliable data, evidence, is therefore more objective. - Better structured results, easily analysed and presented in accessible manner; - Harder for interest groups to influence the results.	- Lack of data; - Not all phenomena can be quantified; - Narrow thinking 'lock-ins', hard to notice 'weak signs'; - Stakeholders and target groups may lack ownership if they are not involved.	- Quantitative analysis combined with qualitative analysis (e.g. literature review). - Participatory methods applied (see above) involving expert knowledge and consensus building.

- It impedes rather than facilitates inter-sectoral cooperation that is needed for the development, commercialisation and spill-overs of innovations;
- It is focused on measurable statistical units, but neglects cross-sectoral challenges (for e.g. climate change) or opportunities (for e.g. application of mobile communication technologies in a broad range of new areas). As a result potential synergies remain unexploited.
- It is not sufficiently focused on expected outcomes that implementation should aim to achieve. This impedes management of implementation and accountability to the society.
- It emphasises competitiveness or growth of identified sectors, which does not necessarily lead to tackling the most prominent challenges faced by the society.

In contrast to the traditional approach, the current exercise seeks to foster interactions between sectors by linking priorities with emerging opportunities and challenges and focusing on measurable outcomes. A dual approach is implemented by distinguishing the 'priority area' from specific 'priority'. Accordingly a priority area is understood as a broader field of concerted actions of government, research and business community with the highest potential in responding to key emerging drivers and challenges that could have a significant effect on Lithuanian R&D and innovation system and competitiveness of the economy. A priority is thus a specific specialisation within a priority area and refers to the development of a new output — technology or process — that has high potential to transform Lithuanian economy. Technologies and processes are understood as applications of knowledge that has the following characteristics: is systematised and based on experimentation and/or scientific theory, may involve new discoveries, current knowledge, or a combination of both, is directed towards application or achieving a goal rather than only towards understanding, is reproducible and transferable.

Assessment and selection of priority areas and priorities rested on three main criteria, which provided that a priority represents the following.

1. An appropriate approach to a recognised national challenge and/or a European (in the context of Europe 2020) or global challenge to which Lithuania needs to contribute to finding a response.
2. A new technology or process that can be developed by exploiting existing public and private R&D capacities. This could involve application of key enabling technologies (KETs) in traditional/non-innovative sectors, application of existing technologies/processes or KETs to new domain or existing sectors.
3. High potential to transform the structure of the Lithuanian economy. This implies that technologies/processes should have a high spill-over potential and considerably boost competitiveness so as to attract a critical mass of imitating firms, which is necessary for structural change.

The adopted methodological approach allows providing dialogue and learning process between different stakeholders, outlining fields for trans-sectoral and public–private partnerships, and foster interactions between different economy sectors and R&D fields.

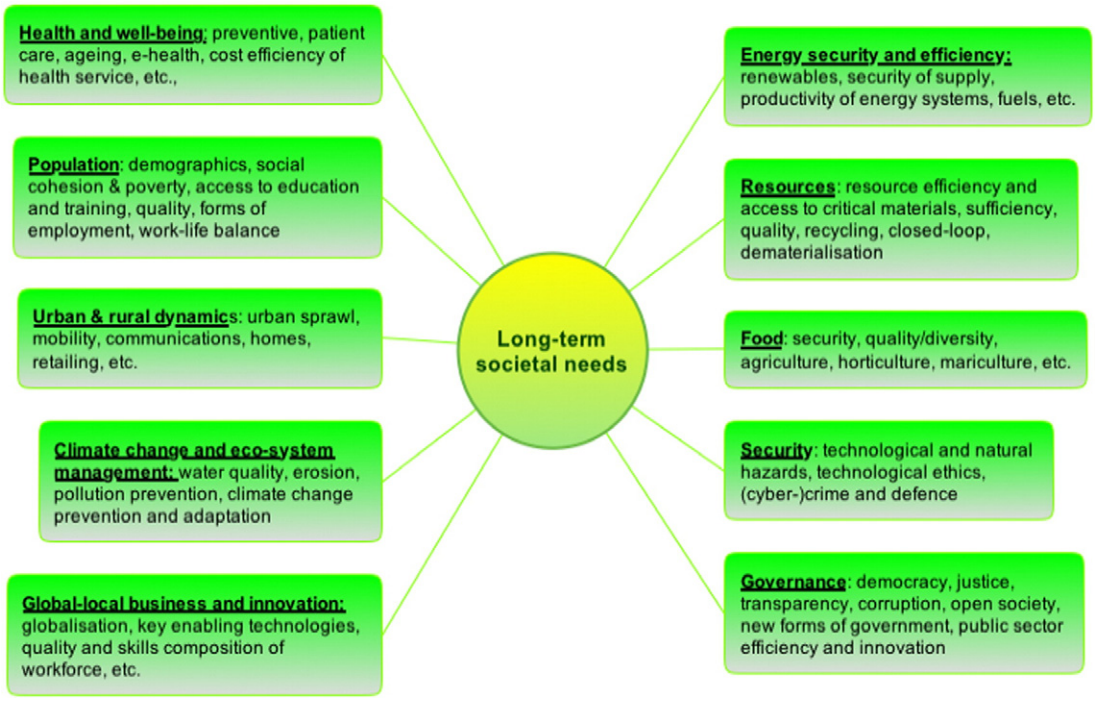

Fig. 2. Key clusters of trends and challenges (Tuytens et al., 2013).

3. Stage 1 results

This chapter provides a brief presentation of the results achieved during Stage 1 — the identification of the S3 priority areas.

3.1. Analytical studies

3.1.1. Analysis of the long term challenges

Two analytical studies on the (i) global trends and drivers as challenges for Lithuanian research and innovation policy and (ii) long term national challenges facing Lithuanian's economy and society were carried out in parallel to maintain the integrity of the outcomes and to build up a basis for assessments of interactions between global trends and 'local' challenges. The first analysis relied on a 'rapid' horizon scan of global trends and challenges that may affect the Lithuanian economy and society before 2030. The types of issues mapped by a horizon scan included current or new/emerging: trends, policies, products, services, stakeholders, technologies, practices, behaviours, attitudes, 'surprises' (wild cards) and 'seeds of change' (weak signals) (Tuytens et al., 2013). The findings were grouped into eleven major fields with main trends and drivers within each of the field, as depicted by Fig. 2.

Selected fields represent the global outward dimension that will have the effect on the socioeconomic wellbeing of the country. Analysis of the long-term national challenges facing Lithuanian's economy and society has a focus on an inward dimension. It was carried out on the basis of meta-analysis of over 70 Lithuanian national studies, expert reports, and other national policy documents, in order to identify key national challenges and the potential response to them up to the year of 2030 (Paliokaitė et al., 2013). The aim and scope of the analysis were in correspondence with the global trends presented in the previous analysis and were grouped into the same ten fields. The results of both analytical studies — a list of key national and global long term challenges — are presented in Annex A.

3.1.2. Research potential in Lithuania

The potential of research in Lithuania was analysed in order to get an evidence-based assessment of the existing R&D capabilities, including both fields of scientific excellence and fields of most intensive science–business collaboration. The methodology of this assessment exercise was based on statistical and bibliometrical analysis. Indicators (e.g. research impact, highly-cited publications) used in this study provided basis to rank a particular research area (according to the Frascati Manual's classification) relatively to others revealing the leading and lagging research areas. A binary scoring was adopted in order to make quantitative analysis simple and flexible. Numerical values '1' or '0' were assigned to the 'leaders' and 'underperformers' correspondingly (Valinčius et al., 2013). Fig. 3 summarizes 'top notch' and 'prospective' fields of the Lithuanian research potential.

Research Areas	SCORE															
	Impact of research	Joint international publications	Frequently cited papers	National funding	International funding	International activity of doctoral students	Post-doctoral activities	Students' activity in research	Participation in Marie-Curie Programme	Infrastructure	Local business grants	International business grants	Joint publications with businesses	Ino-voucher programme	Overall rating	
Physics	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**14**	Top notch
Materials engineering	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**14**	
Chemistry	1	1	1	1		1	1	1	1	1	1	1	1	1	**13**	
Biological sciences-Life Sciences	1	1	1	1	1	1	1	1	1	1			1	1	**12**	
Earth and related Environmental sciences	1	1	1	1	1	1	1			1	1		1		**10**	
Clinical medicine	1	1	1	1	1	1		1	1			1	1		**10**	
Electrical, Electronic and Information engineering					1			1		1	1	1	1	1	**7**	Prospective
Economics and Business incl. Management	1		1	1		1		1	1					1	**7**	
Civil engineering	1		1			1					1		1	1	**6**	
Mathematics	1		1	1			1		1						**5**	
Environmental engineering					1		1				1	1		1	**5**	
Agriculture, Forestry, and Fisheries				1	1				1	1	1				**5**	
Basic medicine	1	1				1				1			1		**5**	

Fig. 3. Assessment of R&D potential in Lithuania (Valinčius et al., 2013).

Fig. 4. Map of the current strengths of Lithuanian economy.

Although a number of research areas (e.g. Health sciences; Food and beverages; Sociology; History and Archaeology; Arts; Computer sciences) were under-scored by this ranking, it did not imply elimination of these areas from the S3 entrepreneurial discovery process.

3.1.3. Review of the strengths of the Lithuanian economy

The aim of review of the strengths of the Lithuanian economy was to provide evidence base for the discussions on the knowledge based growth potential of the Lithuanian economy. This review was aimed at compiling a map of sectors of the Lithuanian economy based on the following criteria (Martinaitis et al., 2013).

- Current competitiveness and specialisation. The present competitive advantage of Lithuania was measured using the following indicators: growth of competitive advantage in export markets, increase in value added, competitive strategies of businesses, based on growing productivity and quality job creation, FDI attraction, critical mass, the sector had been identified as a priority in previous RDI programmes.
- Potential of knowledge-driven growth. The potential of future development based on the capacity to develop innovative products and services and to develop and apply advanced technologies and processes was measured according to: a large share of innovative enterprises, development of products that are new on the market, expenses for the RDI account for a large part of value added created by the sector, the largest part of expenses for RDI is earmarked for research rather than for the purchase of new equipment, a large part of enterprises participate in international innovation networks.

The analysis has revealed that (see Fig. 4), first, sectors described as 'natural priorities' and 'rising/niche sectors' tend to earmark the largest amounts of R&I investments and tend to create and adopt innovations most actively. These sectors can also be characterised as potential creators of future innovations. However most of them are relatively small (in terms of both value added and employment). Second, at present, export and competitiveness in Lithuania are highly dependent on relatively large traditional sectors, which come under the titles 'current locomotives' and 'sectors in transition' in the overview. For the time being, the majority of enterprises in these sectors are consumers rather than creators of innovation (Martinaitis et al., 2013).

3.2. The online survey

The online survey was carried out in April, 2013 in order to assess the trends and challenges that were identified in "Global trends and drivers as challenges for Lithuanian research and innovation policy" and "Long term national challenges facing Lithuanian's economy and society". The respondents were asked to rank the provided challenges in the order of importance and suggest whether Lithuanian business and/or research have the potential to respond to these challenges. The sample of potential respondents was constructed in the following way.

1. Decision-makers and representatives of administration bodies, associated research and business structures (250 respondents);
2. Randomly selected chief executive officers of companies with a turnover exceeding LTL 1 million in 2011 (1,000 respondents);
3. Randomly selected researchers from Lithuanian research and study institutions (1000 respondents).

614 respondents participated in a survey. The ranking results are provided in Annex B.

3.3. Panel discussions

Based on the results of analytical studies and survey results, the IIEG formulated six preliminary priority areas. The next step was to verify the preliminary selection of the priority areas with the stakeholders. Six panel discussions were organised. The aim of the discussions was twofold.

- Firstly to extract the most important needs and opportunities: what collaborative science and business actions are needed to respond to the long term challenges? How these results could be commercialized?
- Clarify the specific R&D niches with substantial human resources and R&D infrastructure to be used to respond to the challenges.
- Inquire if business companies are interested to participate in the creation of respective technologies, processes and products and bringing them to the market?

Secondly, the discussions aimed to suggest preliminary groups of critical technologies, products or processes that the priority field could incorporate.

The discussions brought together more than 100 experts from the Lithuanian universities, traditional and knowledge intensive businesses along with decision makers from relevant agencies and ministries. This step was important not only for gathering or verifying information required for composition of the priority fields, but more as a binding exercise for further discussions and deeper engagement in the dialogue of all stakeholders representing the knowledge triangle.

3.4. Results: mapping the priority areas

Based on the analyses made and the results of discussions with stakeholders, six priority fields and sub-fields (see Table 2, in alphabetical order) were identified by the group of experts as the ones where a breakthrough can be expected through the implementation of joint research and business projects. The broad priority fields were mapped according to the following criteria: (1) high potential to increase global market share of Lithuanian ventures and commercialise available knowledge; (2) high R&I potential in private sector; (3) high R&D potential in public sector; (4) priority field is an important and appropriate answer to the national and global challenges. Additionally to the criteria listed above IIEG mapped the potential priority fields with 'valleys' — integrated research, studies and business centres which stand for largest investment in R&D infrastructure during the Structural Funds programming period of 2007–2013 for Lithuania. ICT was defined as a horizontal enabler across all priority fields. The sub-fields should be elaborated further in the future stages of the development of the Strategy for Smart Specialisation as listed below, by identifying specific priorities.

Table 2
Priority areas approved in Stage 1 and examples of expected Stage 2 results.

Priority areas	Long term challenges to economy and society	Research potential	Business role	Sub-fields in which tangible structural changes can be expected
Efficient energy system and sustainable environment	***E.g. high energy prices, inefficient use of energy.	High/having prospects	'Consumers' (except ICT)	Planning of sustainable development of the energy sector. Efficient supply of energy. Efficient energy supply networks. Energy production and accumulation technologies and integrated solutions. Environmentally-friendly technologies.
Health, health technologies and biopharmaceuticals	*E.g. ineffective prevention, diagnostics and treatment of chronic diseases.	High	'Creators' and 'Consumers'	Biotechnologies including cell and tissue technologies for medicine and pharmaceutics. Medical and pharmaceutical engineering. Public health technologies. Innovative e-solutions for medicine, e-resources and bio-banks.
Food technologies and agri-innovation	*E.g. food wastage, lack of new nutrition sources.	Having good prospects	'Consumers'	Modern agricultural technologies for sustainable use of biological resources. Innovative and conventional food technologies. Foodstuffs storage and packaging technologies.
New processes, materials and technologies for industry	*E.g. low business productivity and lack of advanced technologies.	High	'Creators' and 'Consumers'	New functional materials for industry. Flexible automated production processes. New product and process design technologies. New production technologies.
Transport, logistics and e-systems	*E.g. the potential of smart technologies in managing logistics and transport flows.	Having good prospects	'Consumers' (except ICT & engineering industry)	Development of transport infrastructure. Development and elaboration of sustainable transport systems. Smart logistic systems. Development and elaboration of efficient ICT.
Inclusive and learning society	***E.g. gap between skills and labour market needs.	Having good prospects/ emerging	'Consumers' (except ICT)	New result-oriented public service provision models. New methods, processes and technologies enabling self-directed learning and transition to a new learning paradigm.

Notes: *Responding to the challenges which have been identified as very important in the analysis; ***responding to the challenges which have been identified as very important in the analysis and which have been identified by most stakeholders as key challenges for Lithuania.

The above-listed priority fields were approved by the Strategic Research and Innovation Council on the 26th of June 2013. Despite the priority areas are too broad and all-inclusive at the present, it is the task of the next phase of S3 process to come up with more specific priorities (specialisations) within those broad fields. There is a risk that under these broad priority areas 'everything is a priority'. However, the priorities for smart specialisation should allow for concentration of resources. Hence, the focus of the second stage of the S3 process in Lithuania should be on defining more specific specialisations with clear evidence of having critical mass of R&I potential closely linked to international value chains, even if it means exclusion of other fields, sectors or technologies that do not meet the criteria

4. Further steps

4.1. Stage 2 and expected outcomes

Further phases of formulation of the Smart Specialisation include two major tasks. Firstly, specific priorities need to be identified in each priority field. One of the key criteria for the selection of specific priorities should be the current business and research collaboration or an explicit interest of businesses to collaborate in the development of technologies/processes. An indicative list of potential technology/process groups was provided above in the section describing the potential sub-fields of each priority field. The specific priorities should be identified on the basis of: a) a thorough analysis of trends and strengths of each field; b) a stakeholders' consensus on specific priorities; c) businesses' commitment to co-finance implementation of priorities; d) research group's commitments to take part in the implementation of priorities. Secondly, it is important to initiate a discussion on the instruments of implementation of the strategy for smart specialisation. Such instruments should include both horizontal and subject measures necessary to achieve a substantial breakthrough in innovation, and ensure compatibility and coordination of measures.

The results of Stage 2 should guide the preparation of the regulatory framework regarding support for R&I from EU Structural Funds in 2014–2020. The list of R&I priorities will be

used as a background for practical implementation of national R&I and industrial policies. The 'policy roadmaps' developed for each specific priority will describe specific targets, policy measures, technology development stages, key R&I projects, etc. These roadmaps will become the basis for thematic R&I priority development programmes. Furthermore, it is expected that the consensus building discussions should contribute to the development of innovative partnerships between businesses and S&T and education communities. The consensus on the R&I priority development achieved in the course of expert panels and other activities should create a platform for further concerted actions and policies that are consistent not just with national strategies but could be shared by all parties involved in their implementation.

4.2. Outlook to the implementation of smart specialisation

Impact of foresight is greatest when the results are used for decision-making. This chapter discusses specific concerns and recommendations related to the implementation of smart specialisation.

A well-performing national innovation system is an essential framework for any holistic attempts to build up knowledge based economies. As the innovation system in Lithuania is still in the early phases of development, improving its performance should be high in agenda also in the context of S3. This includes building up effective organisations, filling the gaps, removing misbalances and facilitating connections between different stakeholders in Lithuania and beyond. But it also assumes moving beyond the current narrow understanding of innovation and circle of 'usual suspects', both in terms of stakeholders involved and activities concerned. S3 should create a favourable environment for underpinning entrepreneurship and innovation and fostering emerging technologies in exports-oriented and high value added market segments where Lithuania has the capacity to attain a competitive advantage and develop greater diversity. Pillars of the S3 policies should include both supply and demand side instruments that provide indirect support to innovations by boosting demand and creating favourable framework conditions for their take up by the market. Hence, key policy changes are needed on these three dimensions.

1. Redefining the role of public sector needs new capacity building. Otherwise discovery and experimentation will fail.
2. Also it needs permanent platforms for consultation with business and research stakeholders — no bottom-up or top-down like it has been today, but partnership.
3. Implementation of horizontal R&I policy and broadening the scope of engagement, i.e. sectoral ministries should be involved as they are the owners of the social challenges where Lithuanian priorities are based on. They have to define the demand and thus should have capacities for demand driven R&I policy in their field. In addition, one of the assumptions of S3 resource concentration is that it should use all public sector levers across different policy domains like higher education, immigration, regulations and standards.

Implementing the S3 is a huge governance challenge. The present governance mode in Lithuania is administrative and reactive rather than proactive and innovative. However to tap the potential of smart specialisation, public authorities and implementation agencies will need to behave less like traditional public bureaucracies and more like innovation animateurs, brokering new connections and conversations in the economy. Therefore it is a huge challenge ahead for Lithuania to adjust its governance to fit with the new demanding role it is expected to play for the successful implementation of S3. Otherwise the entrepreneurial discovery and experimentation as the focal ideas of smart specialisation just remain on paper. Orchestration of policies affecting R&I performance would require both strengthened policy coordination and informed policy design processes. Moreover, sufficient attention and adequate resources should be granted to effective programme management. These have been one of the weakest links, including the risk-aversion in implementing R&I policies, weak capacities of administration, and poor management of programmes.

The design effort of S3 implies that it does not come to an end when the strategy moves on to the implementation phase. A strategy for smart specialisation should evolve and adjust to changes in economic and framework conditions, as well as to emergence of new evidence during implementation (Martinaitis et al., 2013; Foray & Goenaga, 2013). It implies that, first, multiannual research and innovation agendas and priorities' review procedures should be put in place. Some 'priorities' can fail, and new prospective fields can emerge, hence intelligence and review procedures should allow for flexibility. The priority areas should set the multiannual R&I agendas (roadmaps) for the coming seven years. A process for regular review of the priority areas must be put in place, with the possibility to renew the priorities based on specific reported outcomes. Reviewing the priorities should be organised so that the support will not be discontinued too soon, nor continued so long that subsidies are wasted on non-viable priorities. The challenge is to prevent the evaluation process from being captured by the interest groups or by rivals who would like to see it discontinued.

Second, policies and governance processes should take into account different maturity of the priority areas. An allocative rule should be applied as to keep the balance. This suggests different types of policy interventions, different intended results/outcomes from the interventions, and different paces ('two-tier' process) for implementation of the priority areas.

Third, policies should allow adequate processes of entrepreneurial discovery throughout the whole period of S3 implementation. Sufficient time and incentives for entrepreneurial search should be granted, taking that even for the more advanced priorities the S3 approach assumes change and alignment of activities (the major change needed is the shift from 'research for the sake of research' to the 'research for the sake of economy and society'). In practice, it means that the State should support collaboration and provide incentives for experimentation to encourage entrepreneurs and other organisations to become involved in the discovery of specialisations and opportunities for diversification therein. But it also means embedding foresight into the strategy design, implementation and renewal at various (from macro to micro)

levels. Embedding foresight would allow moving from project-based approach towards more continuous horizon scanning activities that aim at spotting technological as well as societal weak signals (Weber, 2012).

5. Conclusion

5.1. Implications for theory and practice

The S3 preparation in Lithuania based on analyses, experts' engagement and participatory process can be considered as precedent in the current policy making practice. The delivery of the Smart specialisation Strategy for Lithuania is the ultimate objective of this process. The methodology is designed so that it could be useful both for the decision makers and the agents in the national economy. The knowledge on the current strengths and future potential to tackle long term challenges will serve as a basis for decisions on the national research and innovation priorities and the related policy mix. The knowledge and participatory discussions on the emerging trends and future technological developments will support the innovative project pipeline development and influence the investment decisions of economic agents. The adopted methodological approach allows to link science push and demand pull approaches, to provide dialogue and learning process between different stakeholders, to outline fields for trans-sectoral and public–private partnerships, and feed both companies' and policies' strategic planning processes. By linking priorities with emerging opportunities and challenges the current exercise is expected to foster entrepreneurial discovery processes, knowledge spill-overs and interactions between different economy sectors and R&D fields. The adopted focus on critical technologies and processes in the selected broader priority areas puts more emphasis on measurable outcomes and hence the results oriented approach.

However, the interpretation and adoption of the concept of smart specialisation into local context need further time and effort, also related to participatory methodologies of decision making based on forward looking activities. First, smart specialisation needs to be communicated, understood and acknowledged. It is a time-consuming process that should be seen as an investment rather than a burden. Considerable time should be allowed for discussions between the different groups of stakeholders in order for the entrepreneurial discoveries to emerge.

Second, governance of S3 has to ensure participation and ownership. The foresight process and implementation of its results has to get stakeholders of different types and levels fully involved. The most important types of organisations that need to be involved in the S3 process are public authorities; universities and other knowledge-based institutions; investors and enterprises; civil society actors; and international experts who can offer benchmarking and peer review services. The S3 process in Lithuania has put considerable efforts in inviting the experts and stakeholders into the discussion. However, involvement of key companies and business sector in general has so far been somewhat limited due to time constraints put on the process, lack of tradition, and failure to motivate the key companies and investors to become part of this process.

Third, holistic view to innovation means that several policy areas are concerned with the S3, beyond the traditional science and technology and economy ministries and agencies. One of the new ideas discussed at the European scale is viewing public sector as a client for innovation. The preliminary priority areas include such sectors as transport, health and energy as well as social challenges (e.g. inclusive society), hence the ministries and agencies responsible for developing these fields should join the discussion and even more — take the (co-)ownership of the priority.

Fourth, S3 process has to encourage innovation and experimentation, so it has to include creative thinking outside the list of fields that are 'usual suspects' for R&I support. The analysis of future trends in the priority areas, discussions with experts in future technologies and future markets, and implementing elements of participatory foresight should allow for thinking 'outside the box' and capturing the changes in the external environment as well as the national economy and science scene.

5.2. Limitations and implications for future research

There are limitations implied by the chosen design. Despite S3 process in Lithuania incorporates considerable amount of analyses and discussions, there is neither existing data nor evidence from the studies performed about the potential of related variety for Lithuania (i.e. there is no cluster or vale-chain based analyses about Lithuanian economy). Moreover, policy-makers have very little understanding of how regions in principle diversify into new growth paths, and to what extent public policy may affect this process. Due to the time and resources constraints the analyses do not include the detailed research on the weak signs and wild cards. The inclusion of foresight methods offering greater creativity and interaction is somewhat limited, due to resources and time constraints, but also because evidence and expertise are preferred by the public administration at this stage. Nevertheless, this exercise is among the first steps towards institutionalising forward-looking activities as well as evidence and consensus based R&I policy making in Lithuania. As the forward-looking culture becomes more mature, new methods and modelling techniques could be considered.

This paper presents the results of the first stages of an ongoing process. It provides the foundation for future studies on the overall effects of the foresight process on smart specialisation in Lithuania. One promising avenue could be to study the emergence and development of innovative partnerships and ideas pipeline as immediate results of the foresight process. Comparisons between countries could be explored in terms of the methodological approach and results achieved, as well as in terms of the S3 implementation.

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Annex A. Results of analysis on international and 'local' long term challenges

Cluster	National challenges	International trends and drivers
Health and well-being	Growth of chronic diseases. Deterioration of mental health of the society. Ineffective public healthcare services system.	Ageing population. Lifestyle diseases, (re-)emerging infectious diseases and antimicrobial resistance. New medical technologies. Rising expectations and abilities.
Energy security and efficiency	Efficiency of energy consumption. Energy transmission and supply networks. Diversification of sources for energy production. Alternative fuels for sustainable transportation and related products.	Increasing energy demand and shifts in power generation. Moving towards sustainable energy provision Dealing with emerging issues.
Population	Ageing society and outward-inward migration. Social exclusion and widening income disparities. Lack of social fabric and social capital.	Need for inclusive labour markets. Flexible labour markets and atypical careers. Balancing work and life. Preserving social cohesion and poverty.
Urban and rural dynamics	Smart and sustainable cities as engines of growth. Management of increasing transport flows. Uneven economic regional development.	Move towards Sustainability. Migration flows. Urban Infrastructure. Urban–rural dynamic.
Climate change and eco-system management	Water quality and air pollution. Deterioration of landscape, soil and biodiversity. Waste disposal, recycling and management	Mitigating global warming. Adapting to climate change. Managing eco-systems.
Global-local business and innovation	Technology spill-overs and clusterisation for new growth areas and global markets. Climbing up the value ladder towards product development and sophistication of production factors. Business processes and brand development. Skills mismatches and deficits. International transport links.	Rapid integration, fragmented economic governance. Future innovation skills needs. Technologies to compete in a globalised world.
Food	Healthy and safe food. Tailor-made food at a 'right' time and place. Rational (minimized waste) processing of traditional food raw materials, exploration of new nutrition sources.	Rising food demand and nutritional transition. Conflicts between food demand and other Objectives. Agro-Innovation and the 'competing risks'.
Resources	Rational exploitation of Baltic Sea potential. Searching, extraction and sustainable use of country's mineral resources.	Increasing consumption of raw and critical materials. Depletion of water resources. Increasing conflicts over land use. Paradigm shift to eco-innovation.
Security	Crime reduction. E-security and cyber-security. Smart defence and disaster risk management.	Occupational health and safety challenges resulting from new technologies. Security challenges resulting from new technologies and ICT. Security challenges resulting from natural hazards and disasters.
Governance	Sustainability of public finances and social protection. Effectiveness of governance and accessibility of public services. Civic empowerment and engagement.	ICT as a driver of governmental transformation. Dealing with changing expectations by citizens. Public Sector Innovation.

Annex B. Results of the stakeholder survey

Key future challenges faced by Lithuania (5 choices) Order of priority (from highest rated to lowest rated challenges)	Importance of challenge, N = 614		Research and business potential		
	N of those considering it as an important challenge	N of the survey participants who evaluated this challenge	N of those who evaluated the challenge potential	Lithuanian businesses have the potential to respond, %age of 614	Lithuanian researchers have the potential to respond, %age of 614
Deteriorating demographic situation	376	61.2%	364	27.2%	18.1%
Regional development disparities, poverty, illegal work and insufficient social cohesion	348	56.7%	338	33.2%	20.4%
Deteriorating public mental health, increasing alienation and intolerance, insufficient fostering of culture	342	55.7%	333	19.1%	29.3%
Insufficient diversification of energy resources, high energy prices, inefficient use of energy	326	53.1%	314	28.7%	32.7%
Lack of business & research, intersectoral and international partnerships in creating and applying knowledge, technologies and innovation	245	39.9%	238	24.3%	28.2%
Gap between skills and labour market needs, insufficient development of talents and creative potential	239	38.9%	234	21.3%	25.7%
Low business productivity and lack of advanced technologies, innovative processes, products and services	207	33.7%	204	22.1%	23.6%
Lack of public sector innovation and governance efficiency	198	32.2%	189	13.2%	15%
Ineffective prevention, diagnostics and treatment of chronic diseases, occupational diseases and lifestyle-related diseases	120	19.5%	118	6.02%	14.7%
Insufficient smart and sustainable urban development	118	19.2%	112	10.9%	13.8%
Insufficient safe and healthy food, food wastage, lack of new nutrition sources	116	18.9%	115	13%	14.2%
Unsustainable change in ecosystems (waste, eco-innovation, air and water quality, landscape, biodiversity etc.)	107	17.4%	106	10.9%	14.2%
Increasing technological, cyber and e-security risks	74	12.1%	71	7.8%	9%
Insufficient utilisation of international transport links and the potential of smart technologies in managing logistics and transport flows	67	10.9%	64	8.5%	7.5
Irrational use of the Baltic Sea's potential and the national mineral resources	45	7.3%	42	4.4%	4.4
Lack of smart solutions in the national defence system in managing the risks of national disasters and other emergencies	17	2.8%	16	1.3%	2%

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