

Report on the network and policies of Estonian universities, research institutions and institutions of professional higher education

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Background

The Estonian Research and Development and Innovation Strategy “Knowledge-based Estonia” 2014-2020, approved by the Riigikogu on 22 January 2014, establishes the target to “support the development of areas of responsibility of institutions of higher education and research and development institutions, also their structural changes, focussing on strategic fundamental activities and the reorganisation of the network of institutions; increase the responsibility of research institutions for the effectiveness of their activities.”

As the new strategy period includes preparations for several large measures for supporting the development of institutions of higher education and research institutions, it would be expedient, prior to implementation of any measures, to review any structural changes that might be needed in the network and policies of institutions to increase the effectiveness and international competitiveness of Estonian research institutions and the system of higher education.

On 25 February 2014, the Research and Development Council (RDC) decided to commission a report on the network and policies of Estonian universities and other research institutions, including institutions of professional higher education. The Council appointed RDC member Gunnar Okk as head of the working group responsible for preparing the report.*

Specification of the reporting assignment

The reporting assignment, prepared by the Ministry of Education and Research, established the following tasks:

- *Evaluate the international competitiveness and development prospects of Estonian universities and other research institutions, including institutions of professional higher education, as well as potential areas where Estonia could have a specific competitive advantage;*
- *Prepare recommendations for Estonia’s participation in the international division of labour in research and higher education and for increasing international cooperation;*
- *Provide an assessment of the current structure of the network of Estonian universities and research institutions (incl. institutions of professional higher education) and make recommendations for reorganisation to boost the international competitiveness of those institutions;*
- *Provide fundamental recommendations and proposals to be used in the reorganisation or consolidation of the network of universities, institutions of higher education and research institutions in light of the best practice of Nordic and other countries;*
- *Assess the general capability of research and development and the innovation system to support Estonia’s socio-economic development, and make suggestions on how to increase this capability.*

**The Research and Development Council is an advisory panel at the Government of the Republic, advising the Government in matters relating to research and development strategy, on the preparation of the draft state budget in respect to the amounts prescribed for research and development and with regard to the different ministries and types of financing for research and development, on the establishment, reorganisation and termination of research and development institutions, and on establishing the conditions and procedures for the evaluation of research and development.*

Preface by the author

*This Report is not a comprehensive academic study but a type of expert assessment or a 'think piece'** with the presented positions and recommendations established on the basis of numerous interviews and examined written sources. It includes both facts and opinions, critical and creative thoughts.*

I have deliberately not included any particular positions or ideas expressed during the interviews or read in written sources. Consequently, I take responsibility for all the emphases and interpretations.

The development prospects of universities and research institutions are connected to a wide spectrum of problematic areas. This Report mainly focuses on two of them – international competitiveness and the financial sustainability of institutions. The primary objective of the Report is to generate ideas and motivate readers to form their own thoughts, which would then materialise in actions.

When preparing this Report over a period of several months, I met various representatives and experts in the education and research field in Estonia and abroad, and also received useful written feedback on a number of ideas. The Ministry of Education and Research provided me with extensive support in terms of content and technical matters.

I would like to thank everyone who donated their time, expressed opinions, provided ideas or supported and helped me in other ways during the preparation of the Report.

Yours sincerely,

Gunnar Okk

**Merriam-Webster Dictionary: Think piece – a piece of writing meant to be thought-provoking and speculative that consists chiefly of background material and personal opinion and analysis.

Wiktionary: Think-piece is an in-depth article that discusses a topic thoroughly and elaborates the writer's point of view, to inspire deep thought related to the article's subject.

1 Main recommendations

- 1. Implement a comprehensive reform of higher education and research, including:**
 - Concentration of the educational and research activities of Estonian universities and research and development institutions in two centres in Tallinn and one centre in Tartu;
 - Pooling the resources of Estonian universities for the international marketing of study opportunities, services and research achievements under a single brand, for the transfer of information and technological development to business and industry, for developing a shared information technological basis of property management and development, and for increasing international cooperation;
 - Independent international assessment of the quality of teaching at Estonian universities and the quality of research at research institutions by subject area;
 - Reduction in the number of curricula and the unnecessary duplication between curricula.

- 2. Redesign the financing model of higher education and research to:**
 - Replace the current free higher education with a system of training contracts;
 - Provide a specific number of Estonian students per year with targeted study loans for studying at the world's top universities;
 - Adjust the proportions of research funding at universities by increasing the base financing percentage.

- 3. Conduct an extensive review of the Finnish and Danish experience in the practical implementation of policy decisions on higher education and research and the results of reforms in those countries.**

2 Recommendations

2.1. Conduct a study on the number of persons with an Estonian bachelor's, master's or doctoral degree (who have not continued their studies) who have been employed in their specialty field in Estonia or abroad within the first year after graduation. The study should also examine the wage level of such persons three years after graduation. Based on the results of the study, consider a significant reduction of admission numbers in the specialties for which there is limited or non-existent demand on the labour market.

2.2. Conduct independent international assessment of the quality of teaching in all specialties at all Estonian universities in comparison to current international standards. Publish the results of assessment. Stop providing courses in specialties where the current level of teaching in Estonia does not conform to current international standards.

2.3. Conduct independent international assessment of the quality of research in all subject areas at all Estonian research institutions in comparison to current international standards. Publish the results of assessment. Stop pursuing the subject areas and research topics that do not conform to the current European research standard.

2.4. Replace the current free higher education with a system of training contracts where the government would finance the studies of Estonian nationals through a loan, which would be cleared if the student completes the studies within a reasonable period of time and is employed in Estonia after graduation for a certain period.

2.5. Permit foreign students, who are employed in Estonia after graduation, to deduct, on an annual basis, a part of their tuition fee from their taxable income in Estonia.

2.6. Provide each year at least 100 Estonian students with a study loan that covers tuition fees and living expenses to enable them to study a specialty field, which is important for Estonia, at an international top-ranking university. The loan would be cleared if the student is employed in Estonia for ten years after his or her studies.

2.7. Adjust the proportions of university research funding to increase the percentage of base financing from the current level of 5-10 per cent to 50 per cent.

2.8. Launch a national programme for creating and developing academic competencies in research and education fields that are important for Estonia's socio-economic development but are currently of insufficient quality.

2.9. Establish a national foundation (funding facility) to provide individual financing programs to bring the world's leading academic experts to teach at Estonian universities. The same foundation could provide regular support for visits of the world's leading scientists, global opinion leaders and recognised experts on management, the economy, politics and other areas to Estonia. Such visits should be arranged on the condition that at least one academic lecture or presentation is held at one of Estonia's universities. In addition to lectures, meetings of those experts with Estonian government figures, top politicians and top managers should be organised, if possible.

2.10. Redesign and consolidate the network of Estonian universities, institutions of higher education and research institutions to boost their international competitiveness and financial sustainability by merging the following institutions*** :

- University of Tartu, Estonian University of Life Sciences, Estonian Biocentre, Tartu Observatory, part of the National Institute of Chemical Physics and Biophysics (depending on compatible research fields and specifics of research projects), Tartu Art College, Estonian Crop Research Institute, and Institute of the Estonian Language;
- Tallinn University of Technology, Estonian Information Technology College, Estonian Maritime Academy, Lääne-Viru College, part of the National Institute of Chemical Physics

***For the purposes of these recommendations, 'merger' is defined as a process that involves, in addition to a legal merger, also an agreement on shared values, main objectives, development strategies, and benchmarks of success. This is likely to lead to increased centralisation of management, reallocation of existing resources, relinquishing certain activities or functions, increased emphasis on existing strengths or prospective fields, and change in internal culture. Successful implementation of such mergers will probably require assistance from professional advisors who have experience with managing similar processes.

and Biophysics (depending on compatible research fields and specifics of research projects), and Tallinn University of Applied Sciences;

- Tallinn University, Estonian Academy of Arts, Estonian Academy of Music and Theatre, Tallinn Health Care College, Tartu Health Care College, and National Institute for Health Development.

2.11. Raise the level of professional competence for the (top-level) management of universities by a significant extent, streamline decision-making processes and make them more transparent. Establish a specific division of responsibilities between members of top management teams.

2.12. Establish a single property management and development company for all universities. Perform a thorough examination of the management principles and previous experiences of similar companies used by Finnish, Danish and Dutch universities, and investigate possibilities for cooperation.

2.13. Establish a shared technology transfer company for all universities to transfer innovation and technological developments to businesses and industries. Appoint a professional with previous successful experience of managing a similar company as the first manager of this company.

2.14. Develop a shared information technology basis for all universities.

2.15. Create a shared academic staff in-service training centre for all universities that provides teacher training.

2.16. Establish a shared marketing company for the international marketing of universities and research achievements, and develop a single trademark and marketing concept. Consider cooperation opportunities with Finland University, the shared marketing company of Finnish universities.

2.17. Provide for educational arrangements ensuring that any particular specialty/curriculum or a closely related specialty is taught only at one university. Stop providing courses in the same or very similar specialties at different universities.

2.18. Implement English curricula and teaching in doctoral studies at all universities where it is possible and justified.

2.19. Implement English curricula and teaching in master's degree studies in the technical and technological fields at all universities.

2.20. Make a proposal to the Research and Innovation Council of Finland on establishing a permanent cooperation committee with the Estonian Research and Development Council (RDC) for regular discussion of cooperation between the universities of the two countries, shared use of research infrastructure, investment coordination, division of labour between the countries and other relevant issues of research cooperation.

2.21. Organise regular joint meetings of the RDC and the Research and Innovation Council of Finland for discussing important matters of education and research cooperation between the countries and the results of the work of the cooperation committee.

3 Current situation

Several important investments have been made in the Estonian research system in recent years, in accordance with the Research and Development and Innovation Strategy. New buildings have been erected and modern scientific equipment has been procured. This has improved the research infrastructure and raised the quality of research in Estonia. According to Thomson Reuters Essential Science Indicators (ESI, 2013), many research fields in Estonia are at the absolute summit of global research, i.e., in the top one per cent.

However, many researchers believe that the Estonian research system has reached a turning point, because the current levels of financing do not provide society with the required volume of research and do not ensure sustainability for the scientific community. There have been questions about the number of researchers and research fields that the Estonian state and society can afford. How high is the capacity of Estonia's public and business sectors to use research results for the advancement of society? Who should decide the optimum volumes of the research fields that are currently required for Estonia? Clearly, researchers themselves cannot take this decision; rather, it is a strategic and political decision.

At this time, Estonia has six public universities, nine national institutions of professional higher education and one private institution of higher education (with approximately 60,000 students combined), as well as seven state-owned and two public research institutions (Annex 1 to the Final Report). In total, the higher education and research institutions in the public sector provide jobs for 9,130 persons. In 2014, the state budget funding of higher education and research institutions amounted to 327 million euros, corresponding to about four percent of the state budget expenditure.

In total, 351 curricula are offered at the first level of higher education (bachelor's degree and professional higher education), 282 curricula at the second level (master's degree) and 70 curricula at the third level (doctoral studies). Preliminary assessments indicate that several curricula offered by different educational institutions overlap in content and duplicate each other.

The number of foreign students at Estonian institutions of higher education was 2,230 in the academic year 2013/2014 (3.7 per cent of all students in Estonia), with the majority of them studying at the Tallinn University of Technology (796 students) and the University of Tartu (466). Most foreign students come from Finland, followed by Turkey, Georgia, Russia, Nigeria, China and India.

The funding of research, development and innovation in Estonia has increased nearly fivefold over the past 10 years. This is the largest increase among all Estonian public sector services. Total R&D expenditure as a percentage of gross domestic product (GDP) has been above the European Union (EU) average since 2011. However, after 2008, the entire growth of the public sector has been achieved through the use of EU Structural Funds, with the nominal contribution of Estonian taxpayers remaining unchanged.

R&D funding has increased primarily in the business sector (nearly 10 times) but also in the public sector, whereas the public sector has almost reached the targeted level of funding, i.e., one per cent of GDP. Even though business sector investments have exceeded the public sector contribution

since 2011, there is still a long way to go to achieve the targeted total of two per cent of GDP. The level of R&D cross-funding (between public and business sectors) is very low in Estonia, amounting to less than 10 per cent of total turnover. The funding of public sector R&D activities by businesses amounts to about three per cent, which is more than double below the EU average. The funding of private sector R&D activities by the public sector is approximately 10 per cent, which is slightly above the EU average.

European funds (and the funds allocated for national programmes and innovation by the Ministry of Economic Affairs) have been used mainly for investment and the development of international cooperation. However, funds have been usually allocated on the basis of evaluation criteria typical of academic research, such as international visibility, measured as the number of published articles and citations. There have been virtually no criteria focusing on the contribution to Estonia's socio-economic development.

The described situation has resulted in the creation of new infrastructure, construction of buildings, procurement of expensive laboratory equipment, apparatus and work premises, but there is often a shortage of funds to cover the running costs of those investments. Investments have often been made without considering the relatively quick obsolescence of specific equipment, which leads to a need for new investments after only a few years. A large portion of EU Structural Funds is no longer spent on non-recurrent projects but has become part of the regular budget.

According to some assessments, another problem is the increasing number of specialists with a doctoral degree (the target is 300 new doctors per year, the current level is at about 200) who search for post-doctoral positions with a term of two or three years outside Estonia and can only find employment at universities. The idea that many of them will be employed in the business sector or in the public service has not materialised.

As a result, the increased research funding for universities with the growing number of doctoral students has caused an increase in academic staff by about 25 per cent in the past 10 years. This is one of the few sectors of public service where the number of employees has increased at such a high rate. At the same time there is increasing pressure to raise the salaries of academic staff.

It could be said that the majority of research conducted at Estonian universities has no direct links to businesses in Estonia or other countries. The total value of the business contracts of universities only amounts to *ca* 20 million euros per year, which is roughly four per cent of turnover.

According to many people interviewed for the Report, Estonia tries to offer courses in too many specialties, including some where there is insufficient academic competency.

As Estonia is a member of the European Union, the professors at Estonian universities should be at the European level. The main criterion, in addition to general education and communication skills, should be active research, which means that a professor regularly publishes articles in major scientific journals and his or her works are cited. An important role of professors at universities is the supervision of master's degree, doctoral and post-doctoral students and, therefore, a person applying for and elected to the position of a professor has to have experience with supervision of doctoral students and has to be a prominent expert in his or her field. Unfortunately, many elected professors have never supervised doctoral students and have no substantial record of research publications.

Participation in the division of labour in Europe was one of Estonia's goals in accessing to the European Union. In terms of higher education and research, this should mean that we do not train specialists in all fields but enable some Estonian specialists to receive training in other prominent European universities. It is probably cheaper to support these people with scholarships instead of providing average or even poor education in Estonia.

4 Audit of the financial sustainability of the infrastructure of research institutions and institutions of professional higher education

In May 2013, the Ministry of Education and Research conducted an internal audit on the "Financial sustainability of the infrastructure of national research institutions and institutions of professional higher education". One of the audit findings was that most of the national research institutions and institutions of professional higher education are faced with permanent financial difficulties, with liquidity indicators being below the critical threshold, and these institutions would not be sustainable in the long term with the current system of financing.

5 Opinions of members of the RDC

During the preparation of the Report, an anonymous survey was conducted among the members of the RDC concerning the current general situation and future prospects of Estonian universities and research institutions (see Annex 3 to the Final Report).

According to the results of the survey 56 per cent of the respondents believed that there is no clear, justified and coordinated division of labour between Estonian universities and research institutions. 67 per cent completely or mostly agreed with the statement that the activities of Estonian universities and research institutions are too dispersed and/or are competing with each other.

Assessing the current situation, 78 per cent of the respondents believed that current management arrangements of universities and research institutions are completely or somewhat not in line with the strategic interests of society and of the country. Universities and research institutions do not maintain sufficient communication with businesses, and with economic and business policymakers, and do not take into consideration their development projections or the needs of the labour market.

67 per cent of the respondents completely or mostly agreed with the statement that Estonian universities and research institutions will probably no longer be competitive in the Baltic Sea region after five years. The majority (78 per cent) supported the position that the network of institutions of higher education and research institutions needs changes and comprehensive reorganisation in the coming years.

6 Objectives of universities and research institutions

§4 of the current Universities Act provides the following definition of the objectives of universities:

"A university is a research, development, educational and cultural institution providing education at bachelor's, master's and doctoral level in several study fields. A university can provide education based on integrated curricula of bachelor's and master's studies and institutions within a university structure can provide professional higher education. The objective of a university is to advance

science and academic traditions, to create and develop opportunities based on integrated educational and research activities for acquiring contemporary higher education in accordance with the higher education standard, to organise continuing education and to provide society with necessary services based on educational and research activities.”

Several countries have in recent years amended their universities acts and specified the expectations of society. For instance, in the Universities Act of 2009 (Yliopistolaki, 2 § Tehtävät (Mission)), Finland has established slightly different objectives to the country’s universities compared to Estonia:

“The mission of the universities is to promote free research and academic and artistic education, to provide higher education based on research, and to educate students to serve their country and humanity. In carrying out their mission, the universities must promote lifelong learning, interact with the surrounding society and promote the impact of research findings and artistic activities on society.”

The Danish Act on Universities of 2011 (Universitetsloven, Kapitel (Chapter) 1, Formål (Purpose), § 2 (3)) establishes the following objective for the country’s universities:

“The university must collaborate with the external environment and contribute to the development of international collaboration. The university’s research and education results must contribute to promoting growth, prosperity and the development of society. As a central knowledge-based body and cultural repository, the university must exchange knowledge and competences with society and encourage its employees to take part in the public debate.”

The role of modern universities should not be limited to ‘providing services’ to society; instead, universities should be active in shaping and developing the surrounding environment and society. In addition to maximising the quality of education and research, universities in modern society should also take some responsibility for the practical utilisation of the results of education and research. In several countries, there is talk of the ‘third role’ of universities as agents in society.

Universities should have sufficient contacts with the makers of economic and business policies; they should have an overview of the needs of the labour market and should be prepared to make corresponding adjustments. Furthermore, every university should be an increasingly important local centre and promoter of lifelong learning in society. In addition, universities and/or research institutions themselves should take primary responsibility for their academic and financial sustainability.

The process of drafting various development and reorganisation plans sometimes leads to the rhetorical question on the actual purpose of the changes, i.e., the wider strategic interests of the Estonian society and state. The best answer to this question can be found in the Preamble to the Constitution of the Republic of Estonia: “... to strengthen and develop the state ... which forms a pledge to present and future generations for their social progress and welfare, which must guarantee the preservation of the Estonian people, the Estonian language and the Estonian culture through the ages.” Any development plans and schemes for the use of national resources should be aligned with this main objective.

7 Quality and competitiveness of research

Digitalisation, the significant contributions of developing countries to the development of research, and the emergence of a global community of scientists have altered the forms of research and led to increased competition.

Estonia is certainly not the only country that sees smart specialisation and a knowledge-based society as the main driving force behind increased competitiveness, welfare and economic growth. Many countries have made radical strategic and political choices in their systems of research and higher education, with a targeted contribution of resources. Such choices are often based on political agreements that transcend the boundaries of political parties and worldviews, and are expressed in coalition agreements or laws, which means that they will also be implemented.

The systems of research, innovation and education constitute an integrated whole. There can be variations between countries in terms of size, structure, emphasis, funding models, level of internationalisation and the historical background of these systems. The common element is an understanding that the results of changes in funding principles or policies can be objectively assessed only after ten years at the earliest. Consequently, it is not easy to establish causal links when analysing research policies.

The quality of research is usually evaluated on the basis of indicators, which are based on citations by other researchers. Even though an assessment of the full impact of research would require additional perspectives, bibliometrics is a relatively adequate method for comparing the quality of research in different countries. One potential indicator is a comparison with the global average. When choosing the preferred research fields, one of the criteria used should be the prospect of at least achieving or exceeding the global average level.

Significant research results are often achieved in international cooperation. A 2014 study by the Academy of Finland indicated that the impact of studies made in cooperation with foreign researchers was occasionally much stronger than the impact of domestic research efforts. Naturally, this requires a selection of partners and the arousal of interest in others for one's ideas and opportunities. Increased international cooperation should be a strategic objective of Estonian research, with targeted efforts to achieve this objective. This means the involvement of foreign researchers in Estonian research efforts and the shared use of research infrastructure.

Another indicator of the quality of research is the ability to compete for international funding and grants. It is important to be attractive to businesses and industries in Estonia and abroad. Some public support could be based on the extent of external funding that can be attracted by a university or a research institution.

In the interviews conducted during the preparation of the Report, several respondents opined that Estonia has difficulties establishing research priorities; the number of centres of excellence is too high and there are plans to establish at least one new centre in each research field. However, only a few centres of excellence are at a truly respectable level of quality. There is a different issue with the 'smart specialisation clusters' that require a symbiosis of a productive economic activity with a competitive research field. Estonia could have five or ten such clusters.

8 Global comparisons of universities and the three success factors of top universities

There are in total over 22,000 universities in the world. The competition between them is extremely fierce and increases with each year. The term ‘world class university’ has become popular in the past 10-15 years in connection with the international ranking of institutions of higher education. According to a widespread belief, a world class university should be in the top 100, or at least the top 200, of a world ranking.

According to the most reputable international rankings (e.g., Times Higher Education Ranking, Jiao Tong University Ranking, Shanghai List, and QS World University Rankings) the world’s best 400 universities of 2014-2015 included six universities from Finland and Denmark, eight universities from Switzerland, 11 from Sweden, 13 from the Netherlands, 73 from the United Kingdom, and 147 from the United States.

The top 50 is dominated by US universities and Europe is represented mainly with English universities. When we look at the top 100, we can also see many other European and Asian universities. A shared feature of all these universities is high-level research, which is combined with at least an equally high level of education. Important factors include an international reputation, a high level of funding, the percentage of foreign students and also the presence of Nobel Prize winners, for instance.

The University of Tartu was the only university in the Baltic countries ranked in QS Top 400, at 379th place. The Tallinn University of Technology was ranked between 501 and 550, the Vilnius University between 551 and 600, and the University of Latvia below 701st place. Estonian, Latvian and Lithuanian universities were not represented in the other three rankings in the year considered.

The world’s top-ranking universities stand out from competitors due to three main factors. Firstly, a high concentration of talented teaching staff, researchers and students. In most cases, the universities pay no attention to the country of origin of these people, prioritising only new ideas and novel approaches. In most leading universities of the world, the share of foreign students is between 18 and 23 per cent, while the share of foreigners in academic staff can be as high as 37 per cent.

The second differentiating aspect in comparison to average universities is associated with larger budgets and a diversity of funding sources. The sources include public support for running costs and research, large research contracts with public and private organisations, income from the sale of patents and licences, donations, gifts and tuition fees. A stronger financial position enables universities to recruit a higher number of the world’s leading lecturers and researchers who can raise the profile of a university, which in turn makes it possible to earn and attract even more funds.

For example, the 2014/2015 budget of Stanford University is roughly four billion euros; the 2013 budget of Harvard University was 3.3 billion euros, while the budgets of the Massachusetts Institute of Technology (MIT) and Cambridge University amounted to 2.5 billion and 1.82 billion euros, respectively.

To compare, the 2014/2015 annual budget of the University of Helsinki is 700 million euros; Stockholm Karolinska Institute could spend 630 million euros in 2013; the budget of Aalto University in Finland is 400 million euros, and the combined budget of all Estonian universities, research institutions and institutions of professional higher education amounts to 395 million euros.

Of course, the above comparisons cannot be used to claim that simply adding resources would automatically lead to increased quality and competitiveness of universities. Instead, they illustrate the competitive environment surrounding Estonian universities and research institutions.

The third success factor of leading universities is a combination of freedom, autonomy and professional management.

World class universities have created an internal environment where competitiveness, critical thinking, innovation and creativity are held in higher regard and promoted more than in other universities. Their autonomy enables faster responses to any changes, because they are not held back by cumbersome internal bureaucracy or externally established complex regulations. If necessary, university management can quickly respond to any changes and can ensure efficient management of existing resources. Top-level management of universities is characterised by transparent and relatively simple decision-making processes, clear strategic preferences, and professional risk management. Leading universities have established more active and open communication lines with economic actors, with their alumni, and with society in general.

Even though different rankings emphasise slightly different aspects when evaluating universities and the position of a particular university can vary in different rankings, the rankings provide a relatively objective representation of the current global competitive situation. They are used by students, academic staff, professors, policymakers and the general public to form opinions and make decisions. For many people, the position in a ranking is a reflection of the quality and status of a university. However, critics believe that rankings lead to a simplified understanding of quality and do not ensure fair treatment of different missions and types of higher education.

It seems that only the first 200 or so universities can be measured according to the same criteria and the ranking loses much of its meaning below the 200th place. Local impact is an important factor for the universities that are not included in the top 200 and it would be unrealistic to expect that they can rise to the very top. However, it is true that the position in a ranking and the ability to maintain representation in rankings is becoming a geopolitical competitive advantage of not only universities but also the countries or regions in which they are located.

9 Competitiveness of small countries

The growing success and welfare of countries and nations depends on their economic (gross domestic product, productivity of labour), social (demographics, education, health, quality of life, individual liberty) and cultural (values, uniqueness, development capacity, distinctiveness) competitiveness. While economic competitiveness can be described through measurable indicators, assessment of social and cultural competitiveness requires consideration of several intangible factors.

The level of economic competitiveness is determined primarily by location, success of the business sector, efficiency of institutions, and the volume of resources available to a country. However, the quality of education, research and innovation systems has a direct impact on the economic, social and cultural competitiveness of a country.

Small countries are generally characterised by limited resources and the consequent marginal economic and military political capacity. However, many small countries have been able to create better than average living and growth conditions compared to large nations and have achieved

success in global competition. This success is based on these countries' capacity for learning and innovation and on conscious choices.

The success of small countries is strongly dependent on the development of the global economy and other global trends, as well as the decisions of a few large foreign investors. These countries often earn most of their revenue from a limited number of export articles. Another problem is associated with a relatively high level of fixed costs required for the functioning of the country. Public sector services have small volumes and economies of scale are difficult to achieve. The state administration is faced with the challenge of creating a sufficient control environment with an optimal number of public officials and of limiting the natural growth of bureaucracy.

However, small countries have several advantages. Compared to large nations, it is easier for them to implement structural changes. The impact of positive changes in a field can be seen sooner and this helps to promote the development of the entire society. It is easier and more natural to create communication networks between fields (politicians, entrepreneurs, researchers, government officials) than in large countries.

If a low level of corruption has been achieved, it is easier to maintain in a small country. Compact territory makes it possible to cover regions with a public transportation infrastructure and make efficient use of labour and natural resources that are located further away from centres. Furthermore, small countries are well suited to being used as a test environment for a service or system.

Competitiveness of a small country depends on its ability to:

- attract global attention in a particular field;
- be attractive to foreign capital and raise investments;
- support domestic businesses in assuming a leading role in international value chains;
- develop a smart migration policy as a source of knowledge transfer to mitigate the shortage of labour and to attract a strategically important workforce;
- develop a high-quality education system;
- be an active, but selective, participant in global knowledge networks, to create and develop relative advantage fields, and mediate innovative knowledge created elsewhere to the local business sector;
- establish priorities and make clear and conscious choices on what is or is not achievable in certain policy areas;
- be flexible in reallocating, combining or linking national resources to solve clearly defined problems that encompass a number of policy areas (ministries);
- engage in or reorganise collaboration between officials of various public authorities, experts and entrepreneurs;
- involve persons living outside the country and having positive opinions about the country (diaspora) in contributing to the country's development .

Small countries have achieved success by targeted focusing and combination of resources and development of cooperation between different ministries, businesses and research institutions. The role of efficient, corruption-free institutions with a minimum level of bureaucracy is particularly important as they can sometimes make a greater contribution to a country's economic growth than its location or foreign trade. It is also important for a country to coordinate its educational processes and to support innovation systems, to spread technological capacity to the private sector in an urgent manner, and to maximise the diversity of links to the rest of the world.

10 Competitive and sustainable universities

Estonia is an open country and the key issue for its development is competitiveness in the widest sense, i.e., the ability of individuals, institutions, economy and culture to be different, create values and solve problems.

Relatively cheap and skilled labour, located next to the Nordic countries, has been the main competitive advantage that has brought success to Estonia in the past 20 years. Even though this advantage can still be used for several years in many sectors, it is obvious that Estonia will be faced with marginalisation without a significant increase in productivity and the average level of education. Most sectors are in urgent need of smart specialisation, which in turn requires extensive structural changes. Higher education and research is one of the key sectors in this context.

A successful, competitive and sustainable university (institution of higher education and/or research) is a resource that a country and society can use to increase its competitiveness and to achieve its development targets while it can also create added value for society in general. It is a catalyst of economic, cultural and intellectual development not only in the country of location but also elsewhere.

The competitiveness of an institution of higher education depends on its long-term (i.e., today and in the future) ability to:

- be attractive and engage talented people with high potential (students, researchers, teaching staff), thereby becoming a highly valued educational institution and employer;
- create a brand that is known beyond academic circles;
- produce highly qualified experts in their respective fields who have received the necessary education in the educational institution for creating new values and solving problems facing individuals, society and the world;
- use the results of research and development at a practical level in social organisation, economy, business/industry and/or cultural development;
- be reliable and open, as management and governance, decision-making processes and reporting are transparent, simple and comprehensible;
- assess current fields of activities in education and research in an objective and critical manner and, if necessary, to make radical decisions on the implementation of changes;
- ensure sustainable management.

The management of a successful and sustainable university has a realistic view of the situation in the managed organisation and a clear strategy for achieving the agreed long-term objectives, which is backed by sufficient human and financial resources.

11 Teaching and studying

High-quality teaching is the main task of institutions of higher education alongside research. The quality of teaching constitutes an important part of the academic reputation of an institution, its ability to transfer knowledge, and its competitiveness.

Even a renowned researcher in a field can be a weak teacher without specific knowledge about teaching. Merely having teaching skills is not sufficient in a modern institution of higher education; in addition, there is a need for knowledge of adult education, andragogy and heutagogy where the

learner is at the centre of the educational process. The teacher is not merely a lecturer but rather a supervisor, helper and coordinator.

Even academic staff members with excellent past results need regular in-service training, because the teaching and learning environments are changing constantly, educational resources are being developed, and new knowledge and skills are required to absorb the changes. In addition to elementary computer literacy, the level of digital literacy of students can sometimes be several times higher than that of the teacher.

Even though the traditional lecture format is still used in the world's leading universities, it has to compete with rapidly developing – and often free – online education systems. For instance, the free Coursera learning portal offers various virtual courses to over 80 partner universities with nearly four million participating students all over the world.

Modern educational work requires teachers to adopt a trans-disciplinary approach, to use innovative thinking and virtual collaboration, and to possess intercultural competence. There is a significantly increased need for having a professional level proficiency in the English language.

Several universities offer live online broadcasts of classroom lectures and have implemented mixed and hybrid versions of e-learning and traditional learning methods. This requires teachers to have skills in providing e-learning consultations and supervision in practical matters. There is a need for changes in approaches and attitudes. For instance, is it sensible to spend time on presenting information that is available online to students in an instant?

Most successful universities of the world place great emphasis on teacher training and the continuing education of academic staff. Several universities are engaged in respective collaboration, maintaining shared training centres and organising joint courses.

The quality of education should be assessed regularly both within institutions and with external audits. Even though this is done in many universities, the results are generally only disclosed to the persons concerned. A recent amendment to the Finnish Universities Act establishes the requirement for all institutions of higher education to disclose the results of assessments.

The presence of foreign teaching staff should generally raise the quality of teaching in a university and motivate a quality increase in the local academic staff. The key issue is the level of knowledge, experience and qualifications of the foreign teaching staff that a university can afford to recruit.

12 Transfer of knowledge, research and technologies to society and businesses

The traditional view of universities as public and non-profit educational and research institutions is undergoing significant changes.

Universities and research institutions are becoming increasingly important for introducing knowledge, research and new technologies to society, economic development and, particularly, to entrepreneurship. Looking at any economically developed and successful region in the world, we can see that it is always backed by a university. However, the existence of a university alone does not guarantee success of the surrounding region. While many results of scientific research are not directly convertible into goods or services, most of them contribute to the development of society in one way or another.

The transfer of knowledge to the economy and the commercialisation of technologies is largely achieved through auxiliary spin-out/spin-off companies at universities and the sale of patents and licences.

The experience of the world's leading universities indicates that this role often requires extensive reorganisation of the entire university structure and purposeful changes in management. Changes are required in many internal rules and policies, thinking habits and work culture. Many universities are not prepared or are simply unwilling to commit to that.

Even though it is impossible to measure the impact of universities on the development of society as a whole, their impact on the economy can be estimated in quantitative terms based on the number of registered patents, sold licences and successful spin-outs/spin-offs. Successful commercialisation of knowledge and innovative ideas can generate considerable additional income and provide students with business experience. However, running and maintaining spin-outs/spin-offs requires a different type of knowledge and experience than that, which can be traditionally found at universities.

Successful knowledge and technology transfer does not only require collaboration with domestic and/or foreign entrepreneurs and businesses. Equally important are trusting relations with local governments, the central government and the general public. Any legal issues related to intellectual property have to be resolved as well.

Most leading universities in the world have established special technology transfer offices (TTOs). Such offices function as internal structural units of universities or as separate companies owned by universities. TTOs are managed by and they employ people with specific skills and experiences, who have an overview of the university's research and development results and who can provide recommendations and have the skills to organise patent registrations, licence sales and the founding and management of spin-outs/spin-offs.

13 Issues of the language of research and study

Estonia and many other smaller countries with their national language continue to debate the role of the national language in research and in higher education in the exact and natural sciences. Arguably, the Estonian language is today among the top 50 of the world's most technologically advanced languages. Having Estonian as one of the official languages of the European Union has certainly contributed to this situation. This requires the constant translation of documents that discuss the new and continuously updated aspects of life.

Tens or even hundreds of new concepts are created every year in all research fields and respective new terms have to be invented. Most of them are published in English research literature or in English conference presentations.

Any serious research finding has to be recognised by several independent experts in the same field. Objectivity in assessing the novelty of a result is the main requirement of the peer-review process. In order to ensure independence, the pool of experts assessing the quality of research should be sufficiently large, because this requirement is almost impossible to meet in a small community. Having been assessed in this manner, research publications are forwarded to databases and become available to other researchers for citation. The scientific communities of small nations are often too small, making it inevitable that publications have to be made in English.

However, there are many examples of researchers whose findings are highly regarded by the international community but who are able to present their work and explain complex matters fluently in their native language in popular science magazines, descriptive research collections, yearbooks, etc. For example, the Proceedings of the Estonian Academy of Sciences, issued in collaboration with universities, are peer-reviewed internationally distributed journals, in which English articles are supplemented by abstracts in Estonian. This communicates a message to the world that Estonian is a science language.

The increasing competitiveness of universities would be inconceivable without greater internationalisation. This in turn requires a sufficient number of high-quality English curricula, a high-level provision of education in English, and availability of required academic staff and foreign students.

The ability to be an attractive employer for the world's leading teaching staff, professors and researchers is a significant indicator of the quality and reputation of universities. However, this is usually not possible today without providing them with auxiliary and support services in English. Instead of average proficiency, both local teaching staff and students should acquire a high level proficiency in English, i.e., C1/C2 level, as a general rule. This is not an issue of language but an issue of competence. It should also be remembered that many jobs, which are available today to people with academic degrees, are essentially international, with English as the daily working language.

Of course, the situation is slightly different in the field of humanities, which is associated with the national language and culture, but even here it is important to present the results outside of the Estonian language sphere in order to enable adequate assessment of the quality of research.

14 Percentage of foreign students and foreign teaching staff

The presence of foreign students and foreign teaching staff is seen as an elementary part of the life of a modern successful university. However, there are rather large differences in the percentage of foreign students between universities. In particular, the percentage of such students raises questions in countries where education is free (e.g., Finland) and no attractive jobs are available to graduates for various reasons.

In small countries, the increasing number of talented foreign students helps to offset problems caused by the local demographic situation. Different backgrounds and contacts of such students help to enrich student life, they can become ambassadors of the university in the world after graduation, etc. However, are these sufficient benefits if a foreign student, who was motivated to study in this country mainly by free education or low living costs, leaves the country immediately after graduation, while the university has spent a considerable amount on his or her education?

Most universities in the world have established tuition fees for foreign students, even if they do not cover the full cost of the education. Some persons interviewed during the preparation of the Report believed that tax incentives on income earned in the respective country could be used as a measure to motivate foreign students to seek employment in the country of location of the university after graduation.

The percentage of foreign students and the learning conditions offered to them are taken into account in the international assessment of universities. In most successful universities, the share of foreign students is between 15 and 25 per cent. In doctoral studies, the number of foreign doctoral students can even exceed the number of local doctoral candidates in some specialties. The share of foreign teaching staff varies between 10 and 20 per cent in most successful universities.

Each university should establish a clear focus and target in internationalisation, depending on the particular characteristics of the university and the curriculum. It is important that foreign students are not invited to Estonia simply because of external or political pressure if it is not possible to provide them with education in English at a professional level.

15 Alumni associations of universities

Alumni associations have been established at nearly all universities in the world. The main purpose of such associations is to maintain connections and networks with former students. Many alumni act as goodwill ambassadors in relation to their former university, promoting the university, improving its reputation, or supporting it with money, time or some other resource.

Alumni donations constitute a considerable source of additional income for the world's leading universities. The donations can be made through various foundations, as project-based donations, or in a will. In Finland, the government adds two euros to every euro donated to universities and there are discussions about raising the government's contribution to three euros.

The alumni of a university can create an international community, providing opportunities for sharing professional information and providing business or career advice in addition to social communication. Being a member of this community can be very motivating for recent graduates.

In addition to organising social events, many universities issue printed or online alumni publications, provide secure communication platforms, offer continuing education opportunities or organise meetings with notable persons connected to the university.

Several universities try to support the alumni movement by awarding various honorary ranks and titles for professional achievements of the alumni. The alumni in turn can provide assessments of the past activities of the university, participate in educational activities, or provide strategic development advice.

Existence of a continually functioning alumni association with professional staff is a crucial factor for successful work with the alumni. This requires material support from the university.

Contributions made by the alumni and their participation in university life is included as one of the assessment criteria in global university comparisons and rankings. According to estimates, there are currently about 150,000 alumni of Estonian universities in the world.

16 Marketing of universities

Successful marketing requires the existence of a brand and an underlying clear and comprehensible concept. The international marketing language of universities uses the concepts of development and sale of education products. International marketing would be impossible without a professionally

developed marketing strategy due to the intense competition between universities and the dynamic variability of marketing channels.

In case of small countries and small universities in global terms, it would be practical to combine the resources of several universities, because developing a brand concept and a strategy is an expensive endeavour. For instance, the Finnish universities of Turku, Eastern Finland and Tampere have founded a company called Finland University. The three universities use this company to coordinate the development of educational products in the fields of academic and continuing education and the international marketing of those products to businesses, governments and non-governmental organisations throughout the world.

The same option could be used by Estonian and Finnish universities together, which would ensure a high level of international marketing, contribute to a regional division of labour, and prevent unnecessary competition with each other.

17 Optimal number of universities

The number of competitive universities in a country depends on objective and subjective factors. The objective factors include the location on the global map, the local demographic situation and the existing university culture, i.e. history, traditions and current situation.

While the connection is not absolute, the mean standard of living and relative welfare also play a role in the case of small countries. This is one of the reasons why a comparison of the number of universities in the global top 100 with the number of inhabitants in respective countries provides an entirely different picture of the world's most successful university countries. Switzerland is in first place, followed by Israel, Denmark, Sweden, Australia, Norway, and Finland. The United States and the United Kingdom, having had the largest number of the world's leading universities throughout the years, occupy only eight and ninth positions, respectively, in this comparison.

A similar trend can also be seen when we look at the number of research publications in a given year per million inhabitants. Again, Switzerland is first, followed by Sweden, Denmark, Finland, and the Netherlands. The United Kingdom is ninth and the United States tenth.

The main subjective success factor for universities is their ability to secure a critical mass of talented students, internationally recognised teaching staff members and researchers or, in other words, the ability to sustain a high quality of education and research. This is largely dependent on the professional management and administrative capacity of universities, financial sustainability, and cohesion with the local society and the world in general. It is important to be able to receive funding from the state, businesses, industries, sponsors and the university's own economic activities.

In the interviews given for this Report, many experts expressed the opinion that each competitive and internationally successful university should be based on a population size of at least one million inhabitants in the country of location. Attempts to resolve internal regional policy problems by directing the development of the network of universities have remained futile in most countries. Several countries have streamlined the university networks as part of the university reform. For instance, the 2006-2007 reform in Denmark transformed 12 universities and 13 national research institutions into eight universities and three research institutions. The Finnish university reform of 2010 reduced the number of universities from 20 to 14. Several persons interviewed for the Report

believed that the number of universities in Finland will further decrease as a result of the current changes and will end up at an optimum level of six or seven universities.

18 Extraordinary characters as sources of information

New creative ideas are the most valuable development resource. Even the most advanced modern science is incapable of providing an exact explanation of the reasons and mechanisms of idea generation. As a rule, some intellectual or emotional inspiration seems to be required in addition to basic knowledge, skills and motivation.

Personal meetings with prominent characters, leading thinkers or persons with extraordinary achievements can serve as powerful sources of inspiration. Several such persons have visited Estonia in recent years. In most cases, they have arrived here as a result of semi-random selection in the framework of business events or at the invitation of the country's senior leadership. As a result, only owners of expensive conference tickets or senior government figures with their entourage have had the chance to meet them. Such events have usually not been accessible to regular students and teaching staff of universities.

Why not organise regular meetings with world-class extraordinary people in Estonian universities, using coordinated efforts and central funding? Such meetings could provide both students and teaching staff with inspiration and they would indirectly contribute to increasing the reputation of universities. For students, such events can provide a powerful impulse that will guide their personal development for many years to come.

As added value, further meetings could be organised with the country's senior leadership or Estonia's top managers and entrepreneurs if possible. The experiences of various countries indicate that several top-level presenters are willing to lower their fees if they have the possibility to meet with heads of state or government representatives.

19 Estonia's labour market structure and need for persons with higher education

The ratio between annual graduates with an academic degree and the actual needs of the labour market is an important topic of discussion in education policy. The debate concerns both the number and professional competencies of those graduates.

With 37 per cent, Estonia has one of the highest shares of inhabitants with higher education among OECD countries. The OECD average is 32 per cent. 45 per cent of Estonian women have higher education, while the corresponding share of men is 28 per cent, which is below the OECD average (30 per cent).

Finland has established the target of having 42 per cent of persons with higher education in the age group of 25-34-year-olds by the year 2020 (the actual level in 2013 was around 30 per cent). However, it could be said that Finland already has too many highly educated unemployed persons and many people are unable to find a job in their studied field neither in their own country nor abroad.

In 2014, Denmark achieved the government's target of having 50 per cent of inhabitants with higher education. At the same time, the percentage of unemployed persons with higher education increased

in the labour market and many people with academic degrees, primarily in the fields of humanities and social studies, had to seek employment in other fields.

From 2015, Denmark intends to make radical cuts in university admission numbers in certain specialties. Universities and ministries are engaged in negotiations on how to improve responsiveness to labour market developments and move from 'soft' specialties towards medicine and technical studies. It is argued that providing higher education to the masses has caused a decline in academic performance requirements. It is likely that the government will lower the current target of 50 per cent.

Switzerland is among the world's most successful countries in terms of adapting the qualifications of the labour force to the volume and needs of the local labour market. With three per cent, it has the lowest level of unemployment of young people among OECD members. At the same time it is notable that only about 30 per cent of young people with secondary education intend to continue their studies at a university level, which is below OECD average (39 per cent), and 14 per cent prefer to continue their studies at institutions of professional higher education, which is above OECD average (11 per cent).

What should be the target for Estonia? According to the 2013 data from Statistics Estonia, the total number of employed persons in Estonia across all professions is 620,000. Based on the division of persons by major professional groups, there were 60,000 managers, 119,000 professionals, 81,000 technicians and associate professionals, and 37,000 clerical support workers. The remaining 320,000 is made up of service and sales workers, skilled workers, and elementary occupations. According to projections, the number of 20-64-year-olds in the labour market will decrease by 44,000 persons in the next five years. Assuming that about 70 per cent of all managers, professionals, associate professionals and clerical support workers should have higher education, this would constitute about 30 per cent of the employable population.

Increasing the efficiency of the education system requires continued and adequate feedback from the labour market. The objective should be to minimise the provision of higher education in specialties for which there is no actual demand in Estonia. The quality of higher education received is also reflected in the wage level that the labour market is willing to pay to persons with respective qualifications.

In conclusion

At the most general level and in an ideal case, the network and policies of universities, research institutions and institutions of professional higher education of a country should be perfectly aligned with the economic and cultural needs and general development strategy of that country.

In the case of higher education and research institutions, we can also talk about best practice, which applies to all academic institutions, irrespective of size or location. This is associated primarily with the quality and existence of such institutions, as well as the relevance and accessibility of their fields of activity. Quality is the crucial criterion.

Based on a realistic assessment of the current general political and economic situation in Estonia, it seems unlikely that public funding of research and development could be significantly increased in the next few years. The future of research and development will depend more on the principles and structure of funding rather than the total volume of funding.

We need strategic choices. While conducting interviews for this Report with more than 30 experts of their respective fields with different backgrounds and experiences, I became increasingly convinced that Estonia has not much time left to make these choices.

The higher education and research institutions of all small countries inevitably have to make clear choices and stop trying to mimic the world's leading universities. The choices should be based on relevance for the development objectives and needs of the country and society. The choices pertain to study fields, fundamental research, applied research, technology transfer and selection of cooperation partners.

Correct choices can only be made if there are clear development goals and needs, and higher education and research institutions have the necessary mechanisms for linking them with the economy and society. The managers of academic institutions need sufficient motivation, management competence and stimuli, and they have to regard relations with society as part of their professional role.

A smoothly functioning system of higher education and research institutions is a value for society in terms of both economic and cultural dimensions as well as more generally from the perspective of the country's competitiveness and sustainability. The changes that have occurred as a result of natural development and system introspection, i.e., from the bottom up, have been insufficient for the required fundamental development boosts in most cases. The natural human resistance to change on the one hand and attempts to find an ideal model for the future on the other hand often lead to a situation where changes are made too late and/or at a too limited scale.

The experience of successful countries indicates that a radical improvement in developing the network of higher education and research institutions and in selecting areas of activity requires political 'top down' decisions and purposeful implementation of those decisions within a relatively short timeframe. The exact nature of these decisions is for each country itself to decide.

A development boost is achieved if dissatisfaction with the current situation, a clear vision of future and a specific action plan together outweigh resistance to change.

List of persons interviewed for the Report

Jaak Aaviksoo – academician, member of the Riigikogu

Dan Breznitz – Professor of innovation studies at the University of Toronto, Director of Academic Research at the Munk School of Global Affairs

Riho Grünthal – Professor of Finnic languages at the University of Helsinki

Pirjo Hirvonen – Professor at the School of Arts, Design and Architecture, Aalto University, Head of Department

Kersti Kaljulaid – Member of the European Court of Auditors, Chair of the Council of the University of Tartu

Volli Kalm – Rector of the University of Tartu, member of the RDC

Alar Karis – Auditor General

Pasi Kaskinen – CEO of Finland University Inc.

Andres Keevallik – Rector of the Tallinn University of Technology, member of the RDC

Christian Ketels – Professor at the Institute of Strategy and Competitiveness, Harvard Business School

Birute Klaas-Lang – Professor at the University of Tartu, Visiting Professor of Estonian language at the University of Helsinki

Jukka Kola – Rector of the University of Helsinki

Tiit Land – Rector of the Tallinn University

Knud Larsen – Doctor of Philosophy, former Secretary General of the Danish Ministry of Research, Innovation and Higher Education

Anita Lehtikoinen – Secretary General of the Finnish Ministry of Education and Culture

Sandor Liive – former Chairman of the Board of Governors of the Tallinn University of Technology

Arto Mustajoki – Dean of the University of Helsinki, Member of the Board of the Academy of Finland, Member of the Finnish Research and Innovation Council

Bente Olsen – Head of Legal Division of the Danish Ministry of Research, Innovation and Higher Education

Indrek Reimand – Deputy Secretary General for Higher Education and Research, Ministry of Education and Research

Mart Saarma – academician, Professor of biotechnology at the University of Helsinki, member of the RDC

Mauno Sievänen – CEO of University Properties of Finland

Ants Sild – CEO of Baltic Computer Systems AS, member of the Assessment Council of the Estonian Higher Education Quality Agency, member of the Executive Committee of Estonian Lifelong Learning Strategy

Tarmo Soomere – academician, Estonian Academy of Sciences

Lauri Tabur – former Rector of the Estonian Academy of Security Sciences

Tanel Tammet – Professor of network software at the Tallinn University of Technology, Head of the Chair

Toomas Tamsar – Chairman of Estonian Employers' Confederation

Tuula Teeri – Rector of Aalto University

Urmas Varblane – academician, Professor of International Business at the University of Tartu

Linnar Viik – Mobi Solutions, Strategist and Partner, member of the RDC

Richard Villems – academician, former President of the Academy of Sciences, member of the RDC

Kalervo Väänänen – Rector of the University of Turku, CEO of Universities Finland (UNIFI)

Johnny Åkerholm – Chairman of the Board at University of Vaasa, adviser to the Economic Council of the Finnish Government

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