ICT Impact on Competencies and Innovations: Regional Applicability of Global Indicators

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Abstract **– Paper deals with the multiple criteria assessment methodology applied for global evaluations of ICT impact on competency, talent potential and innovation, and aims to conclude how suitable it is for the regional assessment of education quality a/o processes determining skills in knowledge economy. Below the attention is given to interdependencies of education and knowledge components with the factors characterizing the ICT impact within multiple criteria evaluations for regional cases (Baltic States), also the factors used for international ratings of academic institutions in Lithuania. The task is to evaluate how much some indicators used by experts for global evaluations and popular ratings of universities could be applied for evaluations of the competencies determining competitive innovativeness of the social activity of countries under review. Also for detailing the intersectorial distributing of limited resources for more rational development of labour & vocational skills. Most of the conclusions emphasize that substantial part of ICT determinants applied for evaluations of global competitiveness help to rank the countries or academic institutions for investment solutions but do not detail the mechanisms determining the professional competencies and innovativeness of business at necessary level.**

Keywords **– ICT indicators; knowledge determinants; core competency determinants; labor & vocational skills; university ratings.**

1. Introduction

The international comparisons of the global competitiveness initiated by the World Bank Group (WB) including reports of WEF and determined by intellectual economy factors, first-of-all innovation include some important core competency determinants interconnected with professional abilities, learning quality and innovativeness of both education and producing organizations [37], [38], [39]. In this context, the *core competencies* could be defined as knowledge, abilities, skills, attitudes and value orientations that are being used for a long period and have the impact on comprehensive development of personality, professional flexibility and mobility, as functional ability to perform adequately certain activities [16]. Their measured determination is rather complicated but is important for strategic human resource management There are some proposals concerning the binary-logit model to explore them and helping to identify the investment in intangible assets, marketing or promotional activities and firm size as significant determinants of core competencies and capabilities [27].

The competitive globalization generate the core competency orientation to permanent learning abilities of the employees participating in their direct activity, their initiativeness and entrepreneurship skills, also readiness to meet the risk [29]. At the same time, the innovation-oriented institution (firm or university) hiring competitive personnel must evaluate their real and perspective learning needs and abilities to develop their professional competencies, provide adequate information, use ICT nets, evaluate expected financial benefits [33], [21]. So, the internal and external factors determining ICT impact on core competencies are interconnected. In education field, it is significant to evaluate separately the core competencies and skills both of teaching personnel and (former) students as evaluated by competitive market (employers) or experts. ICT is widely used in the communication of knowledge, its development and exchange, in curriculum and education management information systems: computer-aided and internet-based training, learning content management and e-assessment (both formative and summative, testing, grading, self-assessing etc.), flexible distance learning, online education, digital educational collaboration, distributed learning, computer-mediated communication, multi- modal instruction, virtual education, personalized adaptive learning, networked virtual learning environments etc. [6], [9], [10], [33]. Modern ICT also helps to monitor and evaluate the differences between global competency parameters and its psychological or managerial components (such as recognition of needs, communicational, conflict managing, decision making, educational, cultural, etc.), determining the quality of professional services.

DOI: 10.18421/TEM54-20
https://dx.doi.org/10.18421/TEM54-20

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As was accented in the Science for Policy Report by the Joint Research Centre, the European Commission, the key emerging bottleneck for the development of a knowledge intensive business sector is the availability of skilled human resources for innovation creation. High outward migration and low quality of education from basic to lifelong learning lead to mismatches in skills 'demand and supply as well as general shortage of skilled labour [28]. According to the Eurostat, employment in high- and medium high-technology manufacturing sectors as share of total employment was in EU 5.7 % and in Lithuania – 1.9 %; respectively in knowledge- intensive service sectors – 39.8 % and 33%. The ICT sector was most innovative – 63.3 % of enterprises [24]. The development of R&D in 2013-2015 and measures for 2014-2020 of *Lithuania's Smart Specialization Strategy* (LSSS) are oriented to the innovative revisions affecting higher education strict innovative specialization priorities, wide e-orientation with help of modern ICT infrastructure (content development technologies, ICT interoperability and infrastructure, cloud computing solutions and services). The main fields of concentrated investments, however, did not include direct ways of developments in skills and competency education, except starting of industrial doctorates [23], [24].

Lithuania ranks 9th in registering property in WB Doing Business Rank 2016 (2nd in EU28), 11th in starting a business (8nd in the EU28), 3rd in the EU28 by enforcing contracts and 24th (10th in the EU28) with respect to ease of doing business (out of 189 economies [38]). The prevailing indicators in researches under review mostly characterize the global impact of ICT not directly on competencies but on their main infrastructural surrounding including quality of education and special professional practice, development of innovative business incubators, also promoting start-ups, tertiary enrollment rate, etc.

The innovation developments are often characterized by patents, publications or royalties per personnel (head) and not by more important indicators such as innovative technologies applied or innovative products or services produced and/ or exported. Anyway, their parameters are related with the overall level of education, the quality of the education system, personnel training and retraining, professional management adequacy, encouraging creativity, the relationship between rewards and performance stability, the country's ability to attract talents from elsewhere and keep their own, mathematics a/o science subjects teaching quality [40]. All of them are useful for characterizing the impact of ICT on competencies and innovations. Some of such data could be collected only by special review or expert evaluations. So, they have shown that in Lithuania and Latvia, the most problematic factors for doing business (besides inefficient government bureaucracy and taxation) are inadequately educated workforce, insufficient capacity to innovate [38].

This review was partly based on previous publications of the author [3], [4], concerning feasibility of global complex indicators for evaluating impact on competencies and innovations used by the WBG, WEF, INSEAD, WIPO etc., such as Network Readiness Index (NRI), Global Innovation Index (GII), Global Talent Competitiveness Index (GTCI) [10], [11], [12]. They revealed that the input and output of global innovations including the impact of ICT can be mostly measured by the employable or labor and vocational skills (LV) and global knowledge (professional, managerial or leadership - GK) skills [13].

The *purpose of* the article below is to reveal some aspects of their interconnections under ICT impact on the core competencies by reviewing both: regional parameters of global comparative evaluations of innovative Baltic economics and comparative parameters of different popular ratings of universities (mostly in Lithuania). The prevailing *method* include multicriterial approach to the system of social and economic parameters characterizing international evaluation of innovative impact on the competitiveness of the countries under review. It is realized by critical review of their multiparametric cobweb interactions, in first case, and criterial inadequacy of competence parameters used by international experts for some university ratings, in other case. Besides, the critical systemic review of conclusions done by international developers of global innovation evaluations also play important role [4], [7], [10], [37-40]. The *object* of the paper are core competence parameters presented in both flows of international evaluations of education institutions and innovative activity; the author is aiming to reveal whether they can be adequately used for progressive education policy and suggest the rational distribution of social and economic resources of the country.

To conclude the research, the core innovation determinants applied in evaluations of global competitiveness help to rank the countries or academic institutions but do not detail the processes and impetus most determining the professional competencies and innovativeness of business and education. They usually focus on investigations of one or the other aspects of an international comparative evaluation different from direct task to ameliorate the competitive education or business policy in the selected country, do not assess the traditions and lifestyle differences, along with the specific needs of a country. The special researches for the evaluations of education quality measuring the acquired competence benefits and suitability as well as detailed evaluations of general and professional competence components are suggested at the next stage of their development.

2. Impact Evaluations within International Competitiveness Reports

The global ICT impact on the skills, competencies and innovations is recognized in all international development evaluations [8-13], [25-26], [35], [37-40], but the techniques of its measurement are too generalized because of lack of comparative international data for most actual content factors. So, WEF subindex of education and skills is measured by adult literacy of the population, part of their overall secondary and higher education; NRI distinguishes such ICT factors as the use of mobile phones and the wider Internet accessibility (cost limitations), use of ICT in education and e-management, also absorption of mathematics and natural science knowledge [39], [40]. That is not enough for sophisticated review of impetus determining regional innovative development.

The multicriterial approach revealed that Lithuania was 31st, Latvia – 33rd and Estonia – 21st by ICT impact on global competitiveness among 142 countries [37], [40]. Per the GTCI, Lithuania ranked 37th among 103 countries, Latvia – 27th and Estonia - the 19th position. A generalized review of the most important educational development factors affecting competitiveness in the Baltic countries (Fig. 1) and their comparison shows that the number of education indicators (number of pupils per teacher, higher education, lifelong learning, part of foreign students, virtual social networking use in the learning process) is on similar level with the exception of the technical or vocational training specialists: Lithuania is far behind the two neighboring Baltic countries, especially lagging from Latvia [13].

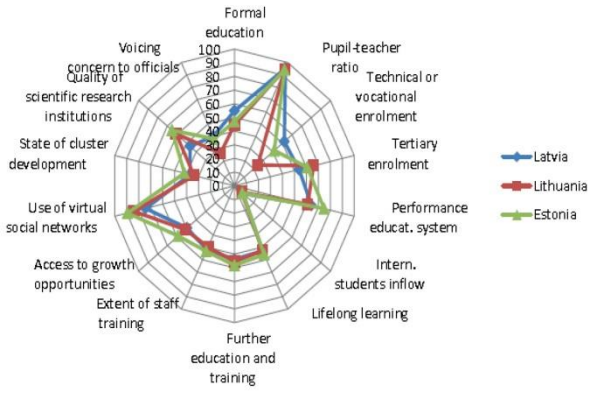

Figure 1. Comparative factors of education and competitiveness in the Baltic countries, 2015.

The cause for concern is the lag of the Baltic States (from neighboring Scandinavian) in national talent development and preservation, as well as in the formation of professional skills needed, increase of the funds for applied research in the Baltic countries because it leads to backwardness by innovation

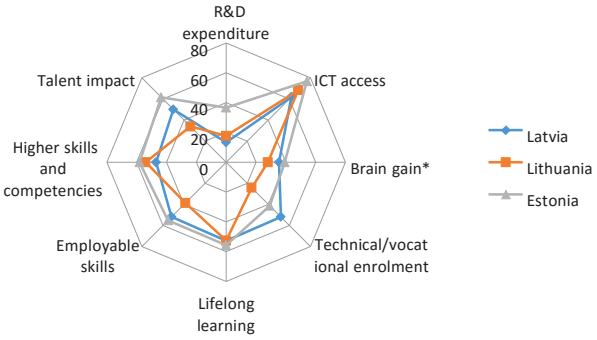

Figure 2. Decisive factors of professional education in the Baltic countries, 2015

performance (return). Fig. 2 revealed that many of those problems are dependent from low level of R&D expenditures determining low brain gain, vocational enrolment and employable skills (especially in Lithuania).

Both more rapid development of professional education and retraining of specialists, along with the education infrastructure including ICT, should be given of greater attention between the global innovation and talent competitiveness indices (together with the use of social networks for developing competence, see GTCI 2015, also university rankings below). From global talent competitiveness index, the components characterizing the professional education, the work efficiency and productivity indicators, the relationship between pay and productivity are also attributed to the factors hindering the ingenuity in Baltic countries (Lithuania). In addition, the export level of professional skills-intensive products and intensive services assessed by the experts are expected to be considered, together with internal impact of the ICT.

Student involvement in scientific research and related innovative business activities through specially prepared study programs, professional practices and other forms of cooperation with business smart specialization events, as well as the international exchange of knowledge and new ICT technologies, organization jointly with foreign academic institutions of graduate courses for teachers and students, and recognition of common diplomas for specialists - all this makes a positive impact on the development of professional competence.

The funding for the study and education, by providing better opportunities to continue their studies and to make full use of the ICT infrastructure, a/o latest digital technology for research and professional skills development (especially those with poorer students), as well as grants and other incentives for young teachers to create the necessary conditions for the development of promising research and business projects is not less important [17].

The escalation of social differentiation took place in recent decades because the part

of the wealthy population concentrated main part of GDP growth in private gains with progress of new digital technologies and ICT innovations based on production and service computerization [5], [9], [14]. In its turn, many Eastern European countries still are applying socially unfair labor income tax, compared to the assets and profits taxation. It was painful, first-of-all, for education of competent students requiring a prolonged professional study (resident doctors, architects), multiple practices or workshops abroad, also supercomputer simulation facilities.

The interaction of professional competency factors in the Baltic countries is presented in Fig. 3. It looks that Lithuania is behind Latvia and Estonia by most of revealed indicators, and has especially outstanding problems with youth employment, employable skills and secondary-educated workforce.

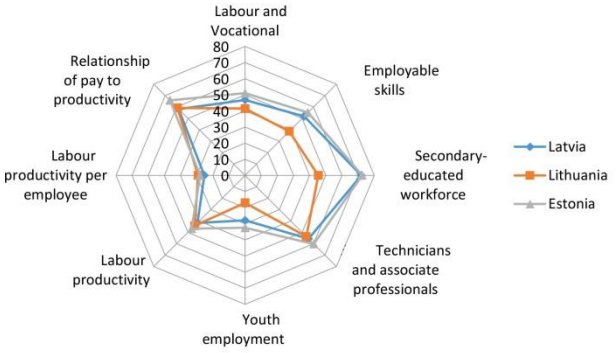

Figure 3. Decisive factors of professional competency in the Baltic countries, 2015

Interesting and valuable is the provided perspective for academic institutions presented by New Media Consortium which paid much attention to the new online e-education, virtual reality, robotics, digital transfer of knowledge and skills, expertise and ingenuity of assessment technologies [26], which should improve the quality of trained specialists and their adaptation to the globalization of society. Among the changes favored by higher educational institutions, the development of creativity, of interdisciplinary studies must be emphasized as process allowing to better use and to acquire the professional skills, also to teach the simplified business, finance, management, sociology and similar courses for engineers, technicians a/o leading specialties helping them to become more quickly the wide profile managers and investors in professional fields. The expert evaluation of differences in combined innovation determinants in the Baltic countries is presented in Fig. 4.

It shows that all Baltic states, and especially Lithuania, have reserves for developing new products of entrepreneurial activity; for Lithuania it is rather serious problem, it depends from rather low evaluation of researchers' productivity and

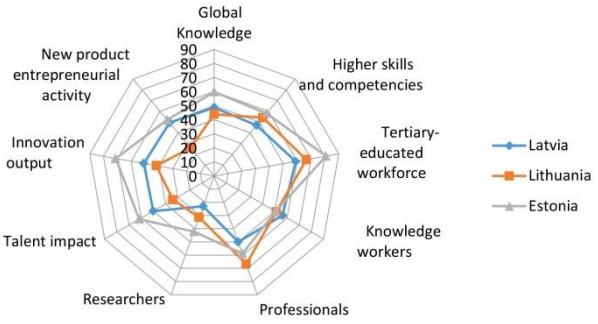

Figure 4. Combined innovation determinants in the Baltic countries, 2015

talent impact on innovation. Thus, Lithuania is significantly behind from Estonia and Latvia by innovation output. Besides, in 2014, most researchers (76.9%) in Lithuania worked in the public sector, while only 23.1% of them were associated with the business enterprises [24].

Most of special skills or professional decisions necessary for the qualified innovation risk assessment can be developed by disposing relevant e.DB and modern ICT means. Rather important is to increase the use of the so-called demonstration packages and other computer tools, experimental classes to consolidate the vocational skills. The new e-learning opportunities liberate in some degree both the students and the teachers from the collective classroom works; the remote virtual studies, "brain battles" and so on are expanded. The new means of the ICT are opening the possibilities for world's best professionals to teach or participate in expert evaluation of educational processes and knowledge certification by using specialized international DB and network devices for distance studies from most continents and countries. The Next Generation Initiative study group set up a special system of incentives for higher education institutions based on deep e-learning processes [25].

3. ICT Impact and Competency Evaluations within International Institutional Ratings

The last decades, the evaluations of ratings for both international universities and specialized higher education institutions have attracted much attention, together promoting the development of national rating systems. Among the most relevant aspects of evaluation, the skilled specialists training quality, parameters of both faculty expertise and degree programs are measured, the adequacy of ICT a/o infrastructure presented for formation of practical and special skills, also impact on innovation indicators, and as result the employment success of the graduates as professionals, their ability to integrate into the labor places in the first year of their careers.

Lithuania's higher education (HE) system, starting its autonomy reform last decades, is attempting to create more competitive and market-oriented competency and skills-fostering institutional system where universities are much independent from centralized governing in personnel policy, financial management, admissions and fees. Some of them starting to apply *artes liberales* principles, introducing the innovative study programs and their financing depending mostly from status of demand and supply in education. This period, developed more intensively after 2009, resulted in some quasi- market deviations in surplus training of jurists and managers so the last year Ministry of Education and Science (MES) successfully started with direct intervention supplying the basket-based system as a primary mean for funding more vide training of engineers, technicians, specialists in natural sciences. Lithuania has allocated 17.5% of its structural funds for core R&D activities to technology transfer and university-enterprise cooperation (the EU average 15.7% [28]), for training and research infrastructure which transfer competence and open access centers of public universities, design and technological works, technical feasibility studies, also promoting open innovation.

The co-funding requirements for academic innovative researches are supported by regulating public authorities. The promotion of new business incubators, evaluation of innovative ideas coming from students or researchers, their commercialization, more wide business access to venture capital markets are important for professional competency forming within universities and is also accounted in some of their rating systems. It is why Lithuania MES included active measures for their development within *Smart specialization programme*, 2016-2020 and 2030 stimulating patenting and certification of new inventions, designs and products. Lithuanian Agency for Science, Innovation and Technology now funds feasibility studies for R&D commercialization and raising activities by universities and research institutes, including specialized trainings on technology transfer and patenting. Also, MES encourages the graduate and postgraduate student placements in innovative companies and firms (Industrial doctorate programs, professional practices and joint experimental researches), renovations of e. study programs.

In 2016, MES initiated a revision of the Law on Higher Education and Research with account of country 's strategic development needs and requests to develop more attractive and competitive education system minimizing the emigration of young graduates and covering the shortage of some specialties because of the brain drain in last years. Also, state institutions started the development of information and e-infrastructures for research and higher education, 2016-2020 [28]. In particular, a virtual empirical data acquisition, storage and dissemination infrastructures such as *LiDA* for humanitarian and social sciences interconnecting Lithuanian research centers with EU social research programs, started [17]. Also, National open access archive of research information (*MIDAS*), *Lituanistika* database of research in social sciences and humanities, Lithuanian academic e-library *eLABa* open access database, must be mentioned. The last one not only interconnects the researches of various regional universities and research centers but also allows participation in the international European and worldwide OA projects, such as NDLTD, DRIVER, DART-Europe, PEER, OpenAIRE [18], [19]. At the same time, better integration of previously developed databases, podcasts [32] and increased accessibility of research outputs (publications, etc.) and data targeted to include up to 40% of publications (at least 10% of collected data should be publicly available free of charge) till the end of 2016 what has significant role for promoting competency development. From 2015, a portal *e-Science Gate* providing e-services to public research institutions and private enterprises facilitates the commercialization of ideas generated in researches (access of e-infrastructure is possible through e-Government gates).

Special studies confirm the increasing mismatch between supply and demand of specialists in Lithuania 's technology sectors: so, one third of the surveyed manufacturing firms lack engineers, technology designers, managers, technologists for realizing their innovative ideas [28]. It was interconnected with the lack of ICT-related innovation services provided by public R&D infrastructures. The EC researchers also revealed that academic institutions in Lithuania do not focus enough on developing such competencies as critical thinking, problem solving, creativity, teamwork, and intercultural and communication skills. The entrepreneurship incentive systems in the Lithuanian universities need more attention on the outcomes of R&D and researchers' career criteria, academic intellectual property policies, development of the knowledge transfer offices, and entrepreneurial skills training. The evaluation of smart specialization strategy by Research and Higher Education Monitoring and Analysis Centre (Lithuania) has shown (as different from prevailing international university rating systems) that the overdependence on academic publications, and insufficient attention to R&D results leads to the lack of motivation at the institutional level [28] and, as result, minimizes the innovative competency.

The detailed regulations imposed by funding organizations may lead beneficiaries to aim at conforming to formal requirements (especially for publications) rather than increasing the quality of the

output ([28], p. 45, 47). The total scientific output of publications per 1,000 of population in Lithuania is below the EU28 average (64.3% of EU28) and is behind by their quality (22nd in the EU by part of publications in 10% of most cited). It is important that low quality publications might outweigh the benefit gained from top-quality ones, and it is suggested by leading institutions indexing science publications (Thomson Reuters) that journals with high level of self-citation would not be counted.

Between the factors determining professional abilities and skills, the e.education must be evaluated adequately, taking into account „the development of interdisciplinary skills such as time management, communication, responsibility, self-confidence, and other specific skills related to the profession... Continued collaboration and a common goal in a flexible and tolerant manner ensured true teamwork, a more professional and less academic part emerged, relegating teaching procedures to professional judgment“ [7].

Measuring within ICT coordinates, the substantial differences are determined by changes going from traditional on-line education to e-learning (and computer-based simulations, also demo training), i.e., ICT-based virtual interconnections, web-based teaching, collaborative software, social networking, m(obile) learning [2], [6], [20], [22], [36] and internationally evaluated achievements [1].

The positive innovative changes in science and education policy ameliorated the rating situation in Lithuanian universities. Below some criteria and results of international university ratings are presented: they are using mostly the similar indicators but different sources of information and rather formally comparing the levels and parameters of ICT infrastructure. Some of them are based mostly on volume of the Web contents (or web links/webpages ratio, Spanish National Research Council) and another – on official institutional answers both not always complete. In some cases, the more reasonable evaluation of ICT impact on innovative education, vocational training and scientific researches requires to add special detailed surveys [8], [30], [31], [34], also [15]. In many of them, the web contents are evaluated as a reliable indicator of the global performance and prestige of the universities.

Between measured factors, *Webometrics* ranking system included the visibility and impact of Web pages (publications) per the number of external in-links (site citations) they received as indirect way to measure all the university missions (teaching, research, transfer). When calculating total rank, visibility brings 50%, size of Web pages 20%, rich files 15% and scientific papers 15% of final rank mostly within central domain what is not always acceptable. Also, the Webometrics algorithm does not detail in transparent way all the significant components of multisided activity of the universities.

Two more universal and four specialized Lithuanian universities were selected from *Webometrics* for comparative evaluations of its applicability limits (Table 1). For most of them, the impact factors were on much lover position (except KUT), openness and excellence factors prevailed higher than the presence for some specialized universities (KUT, LUHS).

Some researches revealed as nonacceptable methodologically such Webometrics algorithm features as ignorance of web pages used by internal university divisions etc. but its positive role consist in accenting the significance of ICT and modern DB in transforming the learning and skills education when comparing the perspectiveness of various academic institutions.

QS Ranking system presented more detailed data not only on ranking but also with scoring (Table 2). It shows higher rank for KUT than for VMU especially by employer reputation, faculty / student ratio, publications and their citation [30]. But in such case, it is important to reevaluate some specific differences in the profile on competency education: KUT is mostly oriented to applied sciences and professions, when VMU – to artes liberales, socio-humanitarian orientation. LUHS and LUES were not evaluated in QS Ranking.

European Commission applies *U-multirank* evaluating the universities by education and knowledge transfer quality and their impact on national innovations. It is defined by teaching and learning indicators (with account of the ICT): ratio

Table 1. Ranking of Some Lithuanian Universities by Webometrics Impact Factors, 2016

World rank	Universities	Presence	Impact	Openness	Excellence
694	Vilnius University (VU)	378	971	697	785
1174	Vilnius Gediminas Technical University (VGTU)	779	1815	989	1353
1834	Vytautas Magnus University (VMU)	718	1956	1824	2692
2215	Kaunas University of Technology (KUT)	6481	4401	4330	1898
2236	Lithuanian University of Health Sciences (LUHS)	3977	6720	1188	1770
3397	Lithuanian University of Education Sciences	2956	5889	3884	3654

At the end of 2016, VU ranked between 500 in world rank. Source: [31].

Table 2. Some Lithuanian Universities by QS Rankings, *2016*

QS World / Emerging Europe & Central Asia	Universities by rankings/ scores	Overall score	Academic reputation	Employer Reputation	Faculty / student ratio	Web Impact	Papers per Faculty /Citations per paper (scores)	Internat. Faculty & Intern. Students (only ranking)	Staff with PhD
501-550/ 21	Vilnius University (VU)	81.9	32 / 90.5	22 / 92.3	60 /71.2	44	56 / 72.6	71/ 151+	87 / 74..4
701+/ 43	Vilnius Gediminas Technical University (VGTU)	70.3	61 / 72	35 / 79.3	133 / 38.7	87	88.7 / 87.4	56/ 87	94 / 72
701+ / 51	Kaunas University of Technology (KUT)	63.9	74 / 63.9	33 / 80.3	104 / 47.2	151+	82 / 53	93/ 98	55 / 86.7
701+ / 77	Vytautas Magnus University (VMU)	49.5	85/ 55.3	61 / 58.3	151+/ 81	92	30 / 30	21/ 136	65 / 81
/ Below 200	Aleks. Stulginskis University (ASU)	...	101+	101+	151+	151+	24 / 47	...	151+
/ Below 200	Mykolas Romeris University (MRU)	...	101+	101+	151+	121	62 / 44	83/ 151+	115

Source: [30]. Notes: Significances of components: academic reputation 30, employer reputation 20 % (in the global graduate employment market), faculty / student ratio 15 % (per full-time academic staff member), Web impact 10% (Webometrics), papers per faculty 10% (Elsevier's Scopus), citations per paper in faculty 5 %, international faculty and international students 5%. At the end of 2016, VU ranked between 500 in world rank.

Table 3. Some Lithuanian Universities in U-multirank Evaluations: Teaching, Research, Knowledge transfer, 2015

Universities by ranks	Bachelor graduat. /on time	Master graduat. / on time	Research publications	Research income / citation	Knowledge transfer: private income	Patents awarded	Co-publications with industrial partners
Vilnius University (VU)	B / B	B / B	C	B / D	D	D	C
Vilnius Gediminas Technical University (VGTU)	B /B	C /B	D	B / B	A	E	C
Kaunas University of Technology (KUT)	C /A	B / B	C	B / D	A	E	D
Lithuanian University of Health Sciences (LUHS)	A / B	B / B	C	B / D	C	E	B
Vytautas Magnus University (VMU)	B / A	B / B	D	A / D	C	E	D
Lithuanian University of Education Sciences (LUES)	A / A	C /A	C	D / D	D	E	E

Source: [8]. Notes: expert scores A (Very good), B (Good), C (Average), D (Below average), E (Weak).

Table 3a. Some Lithuanian Universities in U-multirank Evaluations: International Orientation, Regional Engagement, 2015

Universities by ranks	Student mobility	Internat. joint publications	Bachelor graduates working in the region	Regional joint publications	Incomes from regional sources
Vilnius University (VU)	B	A	A	B	D
Vilnius Gediminas Technical University (VGTU)	A	D	A	B	A
Kaunas University of Technology (KUT)	B	D	A	C	A
Lithuanian University of Health Sciences (LUHS)	C	B	A	C	A
Vytautas Magnus University (VMU)	B	**C**	C	A	D
Lithuanian University of Education Sciences (LUES)	C	D	A	A	A

Notes and source the same as at Table 3.

of timely certificated students, innovative knowledge transfer assessment, curriculum quality, know-how transfer, laboratory work experience. In addition, the separate assessment of research experience and teaching of scientific productivity (cited publications, patents) indicators, curriculum internationalization and internships in the region [8]. The priority of this rating is the possibility to compare the universities not only by regions or but also by 13 different subject area - from biology and engineering up to sociology and business studies. U-multirank presented rather different rating for the same universities (Tables 3, 3a): LUES by highest A ranks for graduates at time and regional engagement is on higher position than prestigious VU which is on much lower ranks by most categories of those expert evaluations.

U-multirank separated 16 key performance indicators in the sectors: a) the teaching and learning (individually assessed by selected faculty staff and students reviews for the graduation in time, a common learning experience, study programs and the quality of teaching); b) research (revenue from external studies, publications and citation numbers); c) the transfer of knowledge (income from private sources and joint publications with the number of business partners); d) international orientation (joint degree programs, joint publications, receiving of international grants for research); e) regional engagement (student internships, internship in their region, the regional publications).

The weak point in *U-multirank* comparative evaluations is the fact that ranking priorities are determined as it looks by mechanical summing of ranks for various selected 16th categories of factors without weighing their significances. As a result, some insights and possibilities concerning skill development and especially ICT impact on educational process are not evaluated adequately or even deviated for some institutions. The factors helping to assess the productive and creative potentials of trained specialists are not detailed enough in all previous ranking systems.

The expert assessments, both international and national ratings of educational institutions, the more vide application of ICT nets and means should help correct the obvious shortcomings, to increase the effectiveness of competence development. As obvious benefits of e-learning would be mentioned: personalized content; continual updating; diversity of learners; flexibility – some studies and research done at home; innovative methods of interaction; online control; more motivated and on demand; quality of distant learning; possibilities of corporate on-demand training [6], [22], [36]. At the same time, it is important to mention also some challenges: special equipment needs, retention problems without direct feedback; protection of created new intellectual property; risk presenting the real degrees from virtual institutions.

4. Conclusions

1. The core competency and innovation parameters are closely interconnected and directly dependent from the level of ICT integration within both modern learning (education) and business activities.

2. The global international ICT, innovation and, as result, competitivity evaluations are considering the impact of core competency but do not detail the value of its substantial components and specific features in the countries under review.

3. The modernization of education in competency requires to integrate and develop the critical, entrepreneurial, creative thinking and social capital skills by using more widely the innovative abilities of contemporary ICT technologies.

4. The same situation is revealed in evaluating the widespread international university ratings rather formally comparing the levels and parameters of ICT infrastructure in main fields of innovative education, vocational training and scientific researches.

5. The more detailed evaluation of institutional impact on the competency formation revealed the importance of the cooperation between science and business in Lithuania in the recent years. It must include not only academic organizations like universities and colleges but also integrate the technology transfer centers, science and technological incubators, parks or valleys participating in the implementation of innovative ideas, and must adapt ICT infrastructure for the smart education.

6. The final conclusion would be the suggestion of cointegrated approach in evaluations of ICT impact on education and competencies by joining the global evaluations with regional and sectoral measurements of detailed parameters.

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