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ICT Industry's Challenge in Latvia

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Abstract:

Information and communication technology (ICT) sector can be described as a high value-added industry, whose growth requires qualified workforce, well-developed infrastructure, public institution support, understanding of sectoral growth scenario and its challenges. One of the industry's essential challenges is a shortage of high-skilled ICT professionals in job market that can be considered as impediment of industry's further development.

Thereby the aim of research is to develop possible scenarios for ensuring increase of number of ICT specialist in Latvia. As result their conclusion has been drowning that without changes in the education process in primary and secondary schools as well as without changes in higher education of ICT specialists, ICT industry in Latvia will not have potentialities to ensure its further development, create the interests of global companies to come to here, and will not be able to facilitate the growth of other industries' productivity.

Keywords: *ICT industry, ICT specialists, education, prediction*

JEL code: *I23, J24*

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1. Introduction

Technological progress is a driving force behind the economic growth, citizen engagement and creation of new jobs and workplaces. Information and communication technology (ICT) goods and services are important drivers of productivity, growth, and economic performance (Canadian Trade Commissioner Service, 2015). ICT is reshaping many aspects of the world's economies, governments, and societies (World Bank, 2016). Computers and connectivity more and more have become means for leveraging the technology in business, public administration and society at large. Information and communication technology sector can be described as a high value-added industry, whose growth requires qualified workforce, well-developed infrastructure, public institution support, understanding of sectoral growth scenario and its challenges. Innovations from the ICT sector contribute to changes and developments in other sectors and boost the growth of globalization (LIAA, 2015). Several studies (Jorgenson, 2001), Stiroh (2002) Timmer, Ypma, and van Ark (2003) have confirmed that productivity growth has increased in parallel with the rise in ICT use. Furthermore, ICT accounts for considerable fraction of growth in countries where the use of ICT is more intensive (Perez, Alonso & Lopez, 2015).

One of the industry's essential challenges is a shortage of high-skilled ICT professionals in job market that can be considered as impediment of the industry's further development. The Europe Commission researchers estimate that by year 2020 there could be up to 825,000 unfilled vacancies for ICT professionals (European Commission, 2016). Moreover, there is a need for digital skills for nearly all jobs where digital technology complements existing tasks. Soon 90% of jobs - in such careers as engineering, accountancy, nursing, medicine, art, architecture, and many more - will require digital skills (European Commission, 2016).

Meanwhile the digital readiness in Latvia is at a lower level than on average in EU. According to the Europe's Digital Progress Report (European Commission, 2016), the basic digital skills for people in Latvia in age group between 16 and 74 years is below EU average. Latvia has also one of the lowest share of ICT specialists in labor force (2% versus 3.7% in the EU average) and number of science and technology graduates (13/1000 versus 18/1000 in the EU). All these characteristics can potentially hold back companies in Latvia regarding the digitalization of their businesses and public sector's modernization and public processes digitalization.

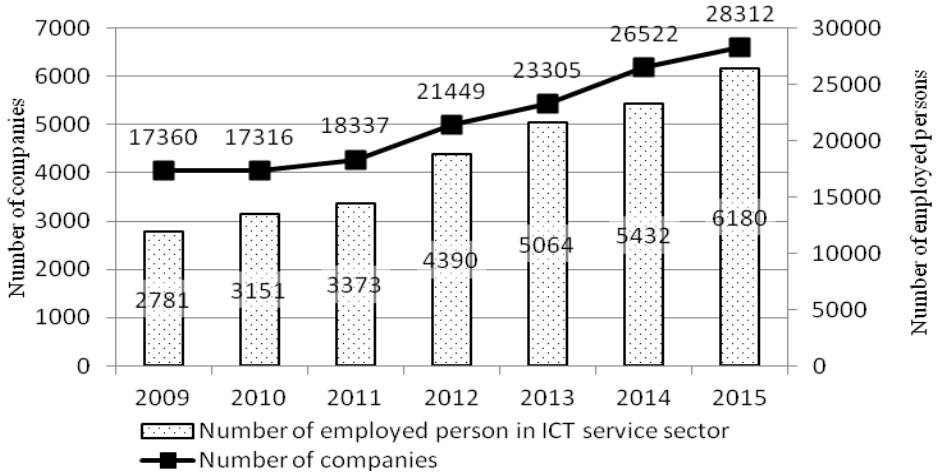
With reference to the above mentioned it is reasonable to believe that ICT industry has positive impact to the growth of every economy. Thereby the aim of research is to describe the ICT industry in Latvia using available statistical data. After review of industry one of the most important obstacle for further development – shortage of ICT specialists is analysed. To increase supply of ICT specialist in labour market the training of specialist is inspected by developing two possible scenarios. Furthermore, there are recommendation determined that for increasing the number of graduated

ICT specialists there is need to attract potential students from the nearest foreign countries.

2. Characteristics of ICT Industry in Latvia

By OECD definition the ICT sector is a combination of manufacturing and services industries that capture transmit and display data and information electronically (OECD, 2007). Main subsectors are ICT manufacturing, ICT wholesale, ICT services (software publishing, telecommunications, computer programming, information technology consultancy, information service activities - Web portals, data processing, hosting activities), repair of computers and communication equipment. ICT industry accounts for approximately 4.8% of Latvia's overall GDP. Over five thousand companies operate in the ICT sector in Latvia, employing over 26.5 thousand people in year 2014 (CSB, 2016). 99% companies can be defined as small and medium sized. Researchers argue that small and medium sized enterprises (SME) are primarily responsible for wealth, economic growth (Mareš D., Dlasková G., 2016.) Figure 1 shows changes in the number of companies and number of employed persons in ICT industry, and development of industry has a growing dynamic over last years.

Figure 1. *ICT sector value added and its share in total GDP*

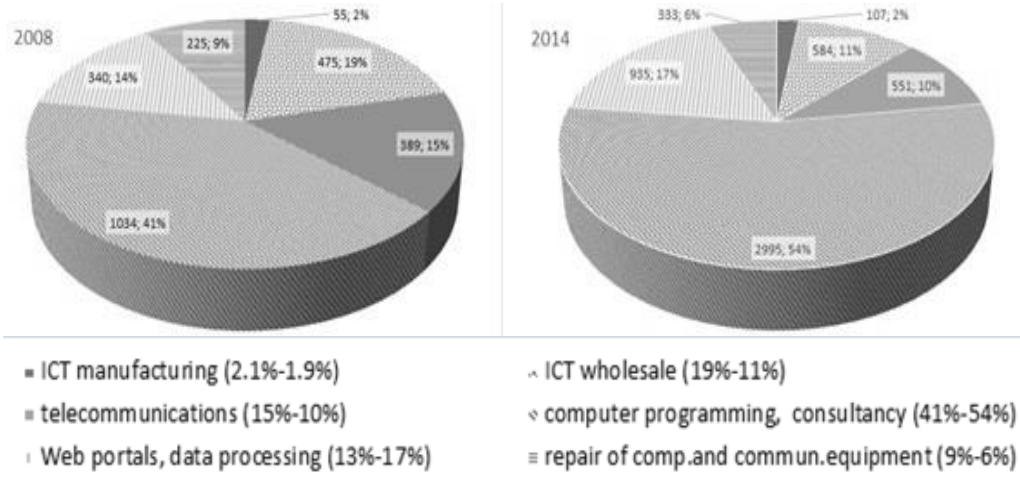


Source: *author's construction based on CSB data*

Figure 2 shows the share of number of ICT industry companies breaking down by the industry's subsectors in years 2008 and 2014. The percentage has reduced in telecommunication and wholesale sector, but in all other sectors it has increased. Most companies of the industry operate in ICT service subsector - computer programming and consulting. From year 2008 to 2014 the number of companies of this subsector has nearly tripled and from the share of 41% increased to 54% of all

companies. At the same time, in computer programming and consultancy the sector employed 45% of all ICT sector's employees.

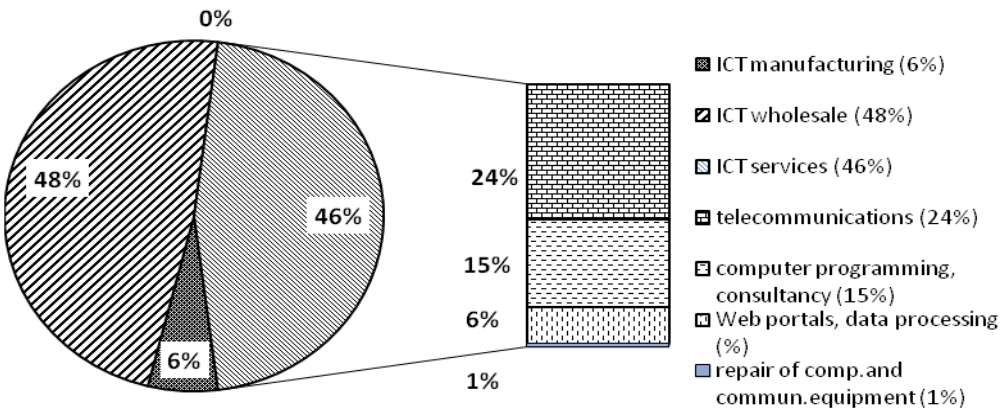
Figure 2. *Number of companies by subsectors of ICT industry in years 2008 and 2014*



Source: *author's construction based on CSB data*

Figure 3 demonstrates that almost one half of the industry's total revenue is generated by wholesale subsector of industry; also, service subsector takes 46% share of total revenue. The largest subsector by number of companies - computer programming and consulting - creates 15% of the industry's total revenue.

Figure 3. *Total revenue by sector*

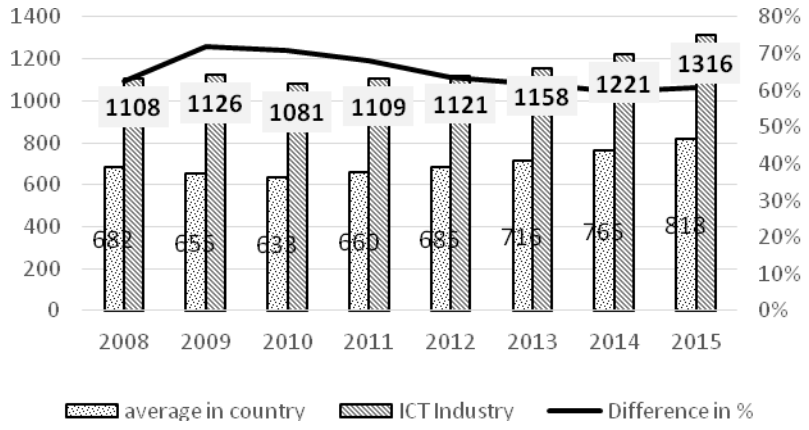


Source*: author's construction based on CSB data*

One of the industry's main characteristics is predominance of small and micro companies. Only one percent of all companies employ more than 50 employees, but 95% of companies employ less than 9 employees (CSB, 2016). Accordingly, the companies of ICT industry depend on human resources, their skills and competences, but the productivity of every employed person in industry is high.

Figure 4 depicts the changes in average salaries of ICT sector in comparison to the average salary in the country. Employees in ICT industry are well payed, also the industry has second highest average salaries (1316 EUR in year 2015) among all industries, which is 161% from average salary in the country (865 EUR 2015). Higher average salaries are only in finance and insurance sector (CSB, 2016).

Figure 4. *Average salaries*



Source: *author's construction based on CSB data*

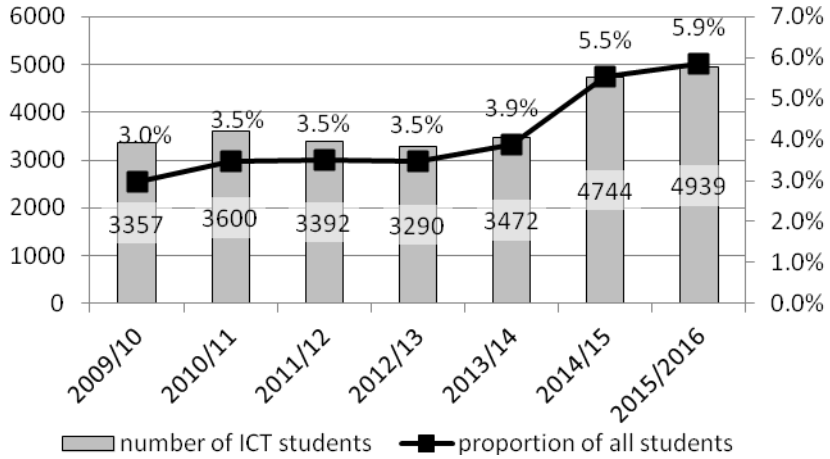
Year by year the average salary is growing overall in the country and also in the industry. That will demonstrate the high potentiality of ICT industry to recruit new workers. Unfortunately, a lack of sufficient number of ICT specialists in labor market is one of ICT industry's challenge not only in the national level but also globally - up to 825,000 unfilled vacancies for ICT professionals by 2020 is predicted by European Commission researches (European Commission, 2016).

3. ICT Specialists and Education

Driving force of every industry is the available specialists who have adequate education, skills and abilities to promote industry further growth. Advantages of the human factors are: quality education, professional skills, professional development, and diplomatic, highly analytical and independent mind, stress tolerance (Posnaya E.A., Vorobyova I.G., Sokolova E.M., Leonova M.P., 2017).

In Latvia, 17.9 thousand ICT specialists form 2.02% of all labor force in the country (Eurostat, 2014). This level is not only behind the average EU level, but also the number of ICT specialists is the lowest in the Baltic states: in Estonia there are 30 thousand ICT specialists, which form 4.9% of labor force; in Lithuania there are 26 thousand specialists forming only 1.9% of labor force. Such shortages of ICT specialists in Latvia will not only delay the further development of the industry but also will not satisfactory provide the demand for ICT specialists for other industries. In year 2015/2016, ICT specialists were taught in 67 different studies program in 17 higher education institutions in Latvia (Ministry of Education and Science, 2016). For the last years there has been increase of the number of students learning in IT programs. Since overall number of students decreases, the share of IT students from total number of students has almost doubled (from 3% in study year 2009/2010 to 5.9% in study year 2015/2016). Figure 6 shows very favorable tendency for ICT industry.

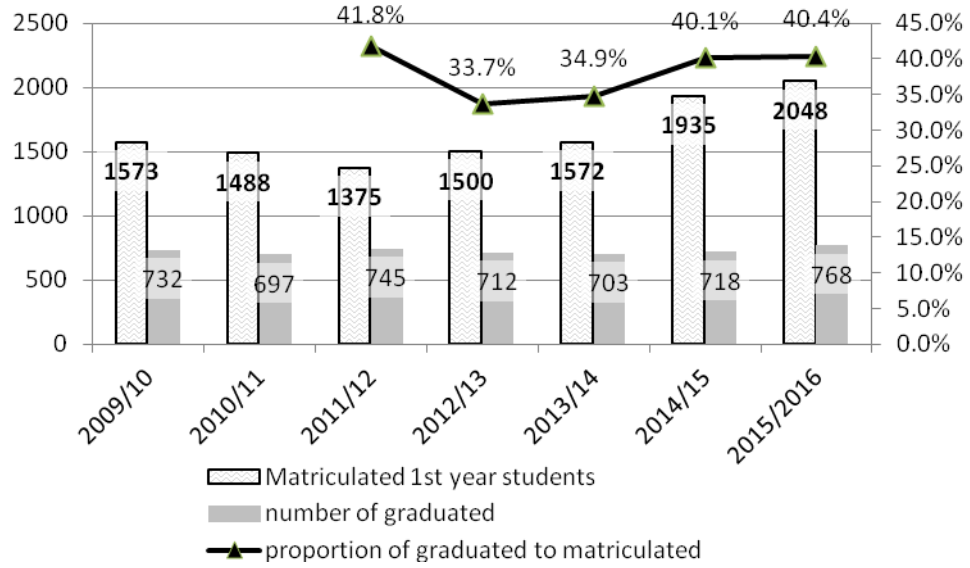
Figure 5. *The number of ICT students*



Source: *author's construction based on Ministry of Education and Science data*

Figure 7 depicts that, unfortunately, the share of graduates is only approximately 40% of matriculated students three year before.

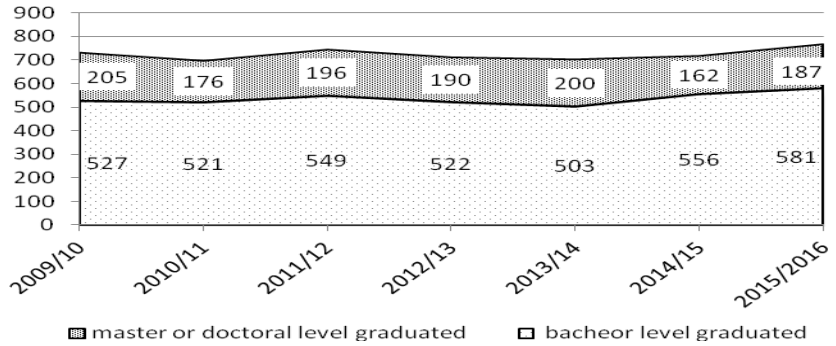
Figure 7. *The number of matriculated and graduated ICT students*



Source: *author's construction based on Ministry of Education and Science data*

One of the reasons for the high drop-out rate could be the student's problems to meet the study course requirements because of low level of STEM (science, technology, and mathematics) subjects' knowledge. Thereby, there emerges the need to promote teaching of the mathematical and algorithmic thinking skills already in general education at primary school level. In addition, it should be noted that number of graduated students covers several education levels, thereby the total number of young ICT specialists is lower because a large part of bachelor degree level graduates continues studies at Master's programs, what is depicted in Figure 8. Thus, the real offer of young professionals in the field of ICT is lower than total statistics demonstrate.

Figure 8. *The number of graduated ICT students by different study level*



Source: *author's construction based on Ministry of Education and Science data*

To ensure the further development of ICT industry in Latvia the feasible scenario has to be considered in order to increase the number of skilled ICT specialists. One of the possibilities for determining the needed number of ICT specialists is to mark out the aim to reach the average level of ICT specialists' share of total employment of EU countries.

4. Modelling the Increase of ICT Specialists

The aim of the research is to model the possible scenarios how to increase the number of ICT specialists in Latvia by means of education. The model is built in several steps:

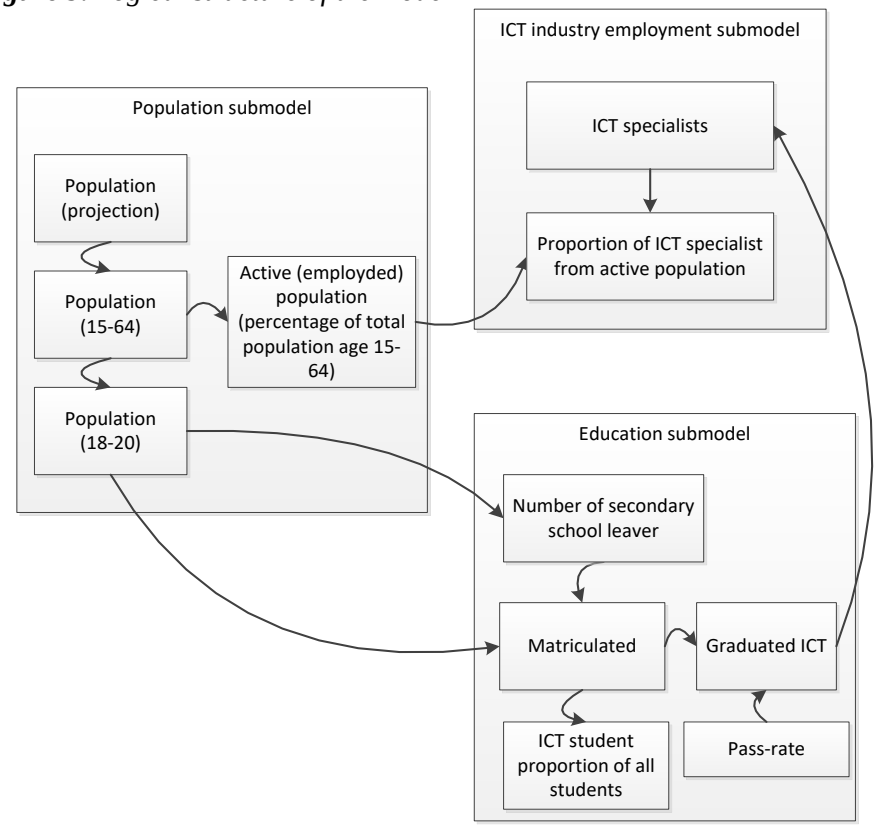
1. The modelling of the needed number of graduated ICT specialists in order to reach the predefined share of ICT specialists as the total number of labour force (analysing two scenarios – reach average EU level 3.7% and catch up with leader countries reaching 5% level).

2. The analyses of the feasibility of the scenarios that were modelled in Step 1 by forecasting the capacity of the projected population.

3. Providing the recommendations and obstacles for fulfilment of the created scenarios.

Figure 9 depicts the logical structure of the model. The population sub model includes the data of the projected number of population by Eurostat. The share of active population is estimated based on the statistical data. The education sub model projects the number of secondary school graduates based on the statistical data. By considering the average pass-rate of students, the number of graduated ICT specialists is calculated. The aim of the model is to reach the predefined share of ICT specialists, thereby the needed growth rate of graduated students for next 10 years is estimated.

Figure 9. *Logical structure of the model*



The following data are used in Step 1: the population projection for years 2016-2026 (Eurostat), the active population of age 15-64 in the percentage of the total population for years 2006-2015 (Eurostat), the number of ICT specialists in year 2014 (The European Commission), the number of matriculated, graduated ICT specialists in years 2010-2016 (statistical data from the Ministry of Education and Science), the number of school graduates in years 2010-2016 (statistical data from the Ministry of Education and Science), the average pass rate for graduated students in ICT study program (statistical data from the Ministry of Education and Science).
The following assumptions are used: that the starting value of the number of ICT specialists in year 2015 is 17.9 thousand (European Commission); and to calculate the required number of ICT specialists, the leave rate of employed persons is considered zero because the average age of ICT specialists is regarded as low.

There are two scenarios analysed for different ICT specialists' share of total employed persons:

1. To reach EU countries average level of 3.7% share of ICT specialists of the total employment in 10 years, the number of ICT specialists have to be 31.34 thousand by year 2026.
2. To reach 5% share of ICT specialists of total employment in 10 years, the number of ICT specialists have to be 42.35 thousand by year 2026.

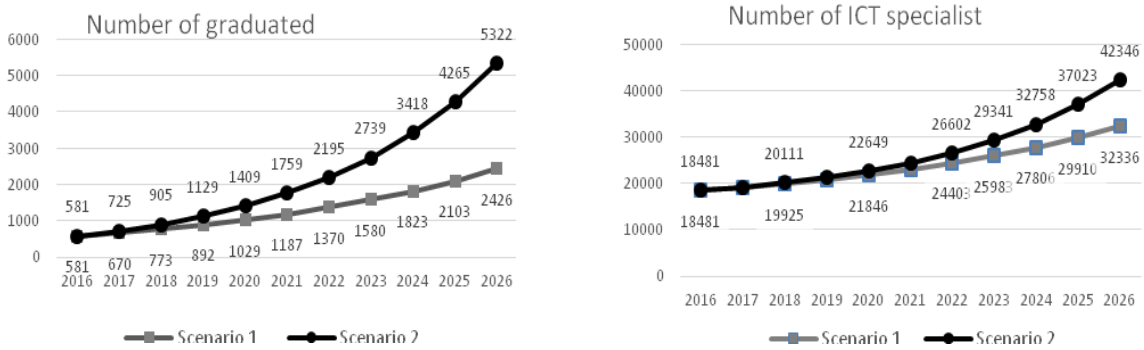
Used calculation technique: MS Excel Solver, GRG Nonlinear solving method.
The following results has been attained for Step 1:

To reach EU countries' average level of 3.7% share of ICT specialists of the total employment in 10 years, the number of graduated students have to grow up 15% annually.

To reach 5% share of ICT specialists of total employment in 10 years, the number of graduated students have to grow up 25% annually.

Figure 10 depicts the number of graduates and the total number of ICT specialists by both calculated scenarios.

Figure 10. The forecasted number of graduates and the number of ICT specialists



The growth rate for graduated ICT specialists is gradual. But to ensure that growth rate, the higher education institutions need substantially to increase the capacity of teaching chance. That could come into effect only with significant state's support not only by increasing the capacity of teaching institutions but also by changing the content of education at primary schools, scaling up knowledges in STEM subjects.

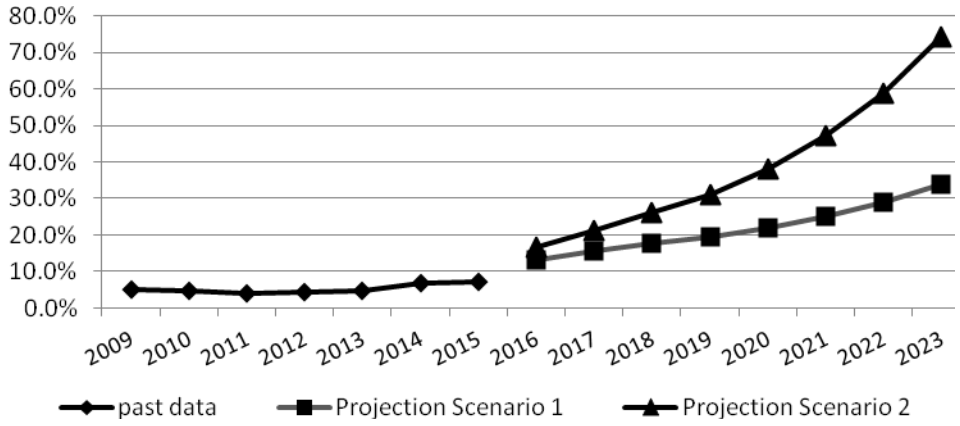
Step 2:
One side of the problem is to calculate how many graduates is needed to reach the predefined share of the ICT professionals from the total employment. The other side is to estimate if this aim is feasible – in this case by keeping close watch at demography. To check the feasibility of the model, the calculated number of graduated students for both scenarios is used. Furthermore, the following data was

used: the number of young people of age 18-20 in years 2009-2015 (Eurostat), the projection of young people of age 18-20 in years 2016-2026 (Eurostat), the number of schools' graduates in years 2009-2015 (the Ministry of Education and Science), the number of matriculated students in higher education institutions in years 2009-2015 (the Ministry of Education and Science), and the number of matriculated and graduated students from ICT program in years 2009-2015 (the Ministry of Education and Science). For modelling purpose, the following values were calculated: based on the share of schools' graduates of age 18-20 from the total population in the past (2009-2015, the Ministry of Education and Science), the linear trend is used to calculate the predicted number of total students for years 2016-2023. Based on the share of matriculated students of age 18-20 from the total population in the past (2009-2015, the Ministry of Education and Science), the moving average is used to calculate the predicted matriculated students for years 2016-2023. The following assumptions are used for modelling purposes: the average study duration is three years. Based on the statistics from past years, the pass-rate after three years' studies is 40%. For the first study year students, the master and doctoral degree students will not be taken in consideration because they have already gained the qualification.

The following results have been attained for Step 2:

Last two years show the relevant growth of matriculated students that will assure that the number of graduated ICT professionals, which was calculated by the model in step 1, is feasible for both scenarios. Although, to reach the modelled growth rate (15% and 25%) for graduated students, the number of matriculated students for forthcoming years are critical values. Based on the population projection, the calculated share from past data about young people, who decide to continue the education, the share of matriculated students in ICT studies program must grow notable. Figure 11 depicts that to ensure the previously calculated number of ICT specialists, the share of matriculated students in ICT study programs must grow exponentially. As the result, there can be found the gap between the projected number of matriculated students and young people in the population in Latvia.

Figure 11. *Forecasted ICT matriculated student share from all student*



As it is impossible to ensure such a potential growth of students by means of the existing human resources in Latvia, it is necessary to attract talented, well-prepared graduates of secondary schools from abroad. The realisation of this plan would be possible using the already gained experience of some higher education study programs, for example, in medicine and healthcare studies that have become as a recognizable export service in Latvia.

5. Conclusions

The paper describes the main characteristics of ICT industry in Latvia and its development for last years. The shortage of ICT specialists can be defined as one of the industry's global challenge. To ensure the further development of ICT industry in Latvia, the attention must be drawn onto the training of ICT specialists.

The education institutions must be aware to increase their capacity to ensure the growing demand for ICT specialists. It could not be done without the significant states' support, for example, by changing the content of education at primary schools, scaling up knowledges in STEM subjects. The other side of ICT industry's challenge is a lack of the sufficient number of young people to be taught. One of the solutions for ensuring the projected number of graduated ICT specialists is to attract potential students from the nearest foreign countries. Since there is a high demand in labor market for ICT specialists, the potential students can be sure that they will have a job in future. Besides, they are interested in digital technologies because of every day involvement in it.

The sufficient number of skilled ICT specialists will also make the region attractive to global companies, who are interested in outsourcing the task. Furthermore, the researchers (Hagsten E., Sabadash A., 2014) have estimated that additional

employed persons with ICT skills will have not only positive influence to the productivity of companies, but also will generate surplus to GDP.

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