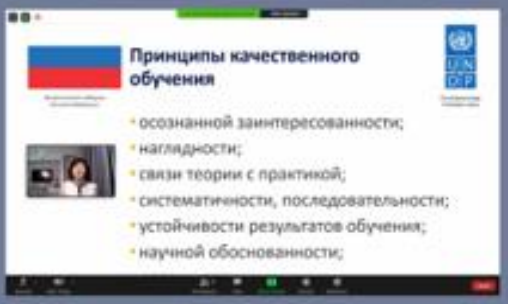

REPORT

DIGITAL SKILLS FOR DIGITAL ECONOMY

Project:

Digital skills and opportunities for youth employment towards digital economy in the Kyrgyz Republic

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List of acronyms

ADB	Asian Development Bank
CEPIS	Council of European Professional Informatics Societies
DCASA	Digital Central Asia - South Asia
DigComp	Structure of digital competence of citizens
ECDL	European Computer Driving License
ICDL	International Computer Driving License
IC^3	Certiport Internet and Computing Core Certification
SDC	Swiss Agency for Development and Cooperation
USAID	United States Agency for International Development
GDP	Gross Domestic Product
HPE	Higher professional education
HEI	Higher education institution
GAMSUMO	State Agency of Local Self-Government and Interethnic Relations
SCITC	State Committee of Information Technologies and Communications
SES	State educational standards
EAEU	Eurasian Economic Union
EU	European Union
DI	Digital intelligence
ICT	Information and Communication Technology
IT	Information Technology
KSTU	Kyrgyz State Technical University n.a. I. Razzakov
KR	Kyrgyz Republic
MoH	Ministry of Health of the Kyrgyz Republic
MoES	Ministry of Education and Science of the Kyrgyz Republic
ILO	International Labour Organization
ITU	International Telecommunication Union
MoE	Ministry of Economy of the Kyrgyz Republic
MoL	Ministry of Labour of the Kyrgyz Republic
NGO	Non-government organization
NSC	National Statistical Committee
OECD	Organization for Economic Cooperation and Development
UNDP	United Nations Development Program
IWI	Independent work with instructor
FIT	Faculty of Information Technology
ICC	Innovation Cooperation Centre
SDG	Sustainable Development Goals
UNESCO	United Nations Educational, Scientific and Cultural Organization

Purpose of the Report

The purpose of the UNDP project is to contribute to the formation of environments and ecosystems for enhancing ICT professional and work skills among youth in order to improve employment or entrepreneurship opportunities, hence to reduce inequalities, ensure inclusive and sustainable economic growth, and create new jobs in Kyrgyzstan.

The essence of the approach will be to create favourable conditions for youth to be enjoy full advantage of the employment and entrepreneurship opportunities offered by the growing digital economy. This envisages carrying out interventions aimed at implementation of systemic changes in the formal education system, as well as active support for successful examples of the effectiveness of non-formal education serving as an accelerator of gradual change throughout the whole ecosystem.

Key objective 1:

Capacity building of the formal education system and apply new educational standards to form digital skills and introduce demand-driven curriculums for better preparation of youth for the digital economy. This objective will be achieved by creating new standards for digital skills and strengthening the institutional capacity of the formal education system (HEIs and lyceums), in order to equip young people with digital skills ready for professional use including basic, intermediate and advanced digital entrepreneurship skills, as well as personal and social skills, and to increase the digital competencies of instructors for better integration of digital skills with the government of Kyrgyzstan in the developing the National Strategy for the Development of Digital Skills and the relevant Action Plan[1].

[1] Draft Project Document: Digital Skills and Employment Opportunities for Youth in the Digital Economy in the Kyrgyz Republic

Introduction

The digital economy sets ambitious goals for the educational sector while dictating new sectors of the economy and professions it reveals a significant non-compliance of skills not only digital, entrepreneurial, but also "soft" skills.

The project document on page 4 indicates that digital skills will be required in 90% of all professions. Basic ICT skills are considered crucial for everyone (page 7) composing the labour resources and those searching new and highly paid jobs. The demand for these skills is growing in all sectors - from agriculture and construction to education, healthcare and services[2].

EAEU Digital Agenda 2025 will provide the Union countries with additional GDP growth of up to 1% per year, as well as **almost 8 million** new jobs by 2025.

Based on IT platforms and products, in addition to direct IT specialties and jobs (related to IT and programming), new supportive and non-technical professions and jobs are being created. According to the US Employment Multipliers Study, per 100 direct IT jobs an additional 193.6 supportive jobs and 180.3 indirect (non- technical) jobs are created[3].

The digital transformation strategy of Taza Koom in 2017 was included in the National Strategy for Sustainable Development 2018-2040. At the end of 2018, the Government of the Kyrgyz Republic developed and approved by the President of the Kyrgyz Republic Sooronbay Jeenbekov a five-year action plan for the Sanarip Kyrgyzstan 2019-2023 program. President S. Jeenbekov designated 2019 year as the “Year of Digitalization and Regional Development”. Sanarip Kyrgyzstan will increase the competitiveness of the economy and allow local businesses to be competitive and in demand in the global market. The strategic goals of the five-year action plan include ensuring economic growth through the digital transformation of economic sectors, business processes and production chains[4]. Sanarip Kyrgyzstan plans to achieve the following indicators for the country in terms of international indicators.

[2] Draft Project Document: Digital Skills and Employment Opportunities for Youth in the Digital Economy in the Kyrgyz Republic

[3] https://www.epi.org/publication/updated-employment-multipliers-for-the-u-s-economy/

[4] http://ict.gov.kg/index.php?r=site%2Fsanarip&cid=27

Table 2. Planned indicators of Kyrgyzstan by international indicators

Name of indicator	Current status	2019	2020	2021	2022	2023
Global ICT Development Index, ITU	109 (2017)	106	101	96	91	86
Position of the Kyrgyz Republic in the Networked Readiness Index, WEF	95 (2016)	90	85	80	75	70
Global Competitiveness Ranking, WEF	102 (2017-2018)	97	92	87	82	77

In this report, it is expected to make an overview of the current situation on digital skills in the formal education system at the Kyrgyz State Technical University. Two options for a digital skills development strategy in IT will be considered taking into account the involvement of higher education institutions. An overview of new digital educational standards will be made based on international and regional experience.

Recommendations for improving the learning management system taking into account ICT skills for instructors and students will be offered.

A needs analysis will be carried out for the development of a Technical Specification for the equipment.

Assessment of supply and demand in the labour market of the Kyrgyz Republic in the context of IT professionals and digital professions

Similarly, as in other markets, the digital job skill market is characterized by the interaction of supply and demand. Due to the dynamic interaction, it is difficult to determine whether the supply of skilled labour is in equilibrium with the demand for it. The shortage of labour resources is the result of such interaction and can be identified by monitoring a number of indicators of the labour market including vacancies of the relevant profile, the level of employment (the share of workers in this profile with low / inappropriate qualifications), and the level of employment of university graduates.

The total annual demand for qualified personnel is defined as

- the volume of demand for expansion,
- net demand for replacement,
- demand arising from skilled jobs occupied by personnel with lower and / or inadequate qualifications.

The demand arising from qualified jobs occupied by personnel with lower and (or) inadequate qualifications is estimated as the number of jobs in the context of professions and qualifications that are employed:

- persons without formal education or sufficient work experience (appropriate to their position);
- persons with education in the inappropriate profile and qualifications;
- persons with education in the appropriate profile who consider themselves insufficiently qualified in comparison with the functional requirements.

The labour supply includes the country's working-age population by qualifications or specialized education. The labour supply includes a number of components, such as:

- current number of employees;
- number of unemployed;
- number of recent university graduates, graduates of vocational education and training institutions, and
- number of people who quit working but decided to return to the labour market.

This assessment should provide information for educational institutions in order to improve the correspondence of the offered services to the demand from the labour market. The biggest debate is now about the concept of "skilled labour" that should include either trained (certified that is important for the IT sector since each technology requires specific knowledge and skills)

workers or experienced workers and technicians who meet the functional requirements (however, given that IT products are very specific it is difficult to find enough opportunities to gain experience with these products).

Analysis of the demand for qualified personnel in digital professions in the Kyrgyz Republic

Demand for expansion by occupation can be calculated only for the next year (s) by extrapolating retrospective trends in regional and sectoral employment, as well as taking into account new investment projects (if any), an increase in exports (if any), etc. Net demand for replacement is the difference between the annual number of vacancies in the context of occupations arising because of employee retirement minus the number of qualified personnel attracted from the labour market (and trained in the industry).

Information technology is a key factor in the development of all other industries. The traditional ways of doing business in every industry are changing due to the appearing of new technologies. For example, today, due to the development of additive manufacturing, many factories automate key stages of the production process. Increasingly, in the value chain, IT is beginning to be an integral part.

Other IT services are not so widespread and not all industries actively use them, in particular: system integration, building IT systems, implementing IS, and staff training.

The IT industry is completely changing the job market. In this sector, the number of jobs is created 2.8 times faster than in all other sectors of the economy.

Sectors	Production	Trade	Transport	Agriculture	Tourism	Media	Education	Public services
Type of services	Software Development and Maintenance - IT Professionals							
	Marketing and Analytics - Digital Specialists							
	Consulting Services - Digital Specialists							
	IT outsourcing - IT professionals							

Figure 1. Types of IT services in the value chain of economic sectors

According to the data of the National Statistical Committee of the Kyrgyz Republic, the share of employed in the “Information and Communication” sector by type of activity is 28.1 thousand people out of 2.38 million employed at the end of 2018. This is about 1.1% of all employed in the economy of Kyrgyzstan. While in Russia this indicator is at the level of 2.44% and world leaders’ indicator reaches 4.3% of the total employed population.

The EAEU Digital Agenda 2025 will provide the Union countries with additional GDP growth of up to 1% per year, as well as almost **8 million** new jobs by 2025.

According to open data from the www.job.kg website, the average number of vacancies in 2019 was 71 per month in relation to the total number of vacancies 926 in the same period (7.6% the share of vacancies) in the category “Internet, IT, telecom, and communications”. In addition, 6776 of the total number of 205 567 resumes in the job bank (cumulative indicator) amounted to 3.3% the share of resumes in the same category. The analysis showed that most often the required work experience is from one to three years. Vacancies are usually posted on job search sites and in groups of the Kyrgyz IT community.

The most complete and structured information on the number and distribution of vacancies by professions was found on the websites www.lalafo.kg , www.job.kg and the Telegram channel Jobs|Devkg. In addition, these resources are leading in terms of the number of visits and subscribers (Appendix 3).

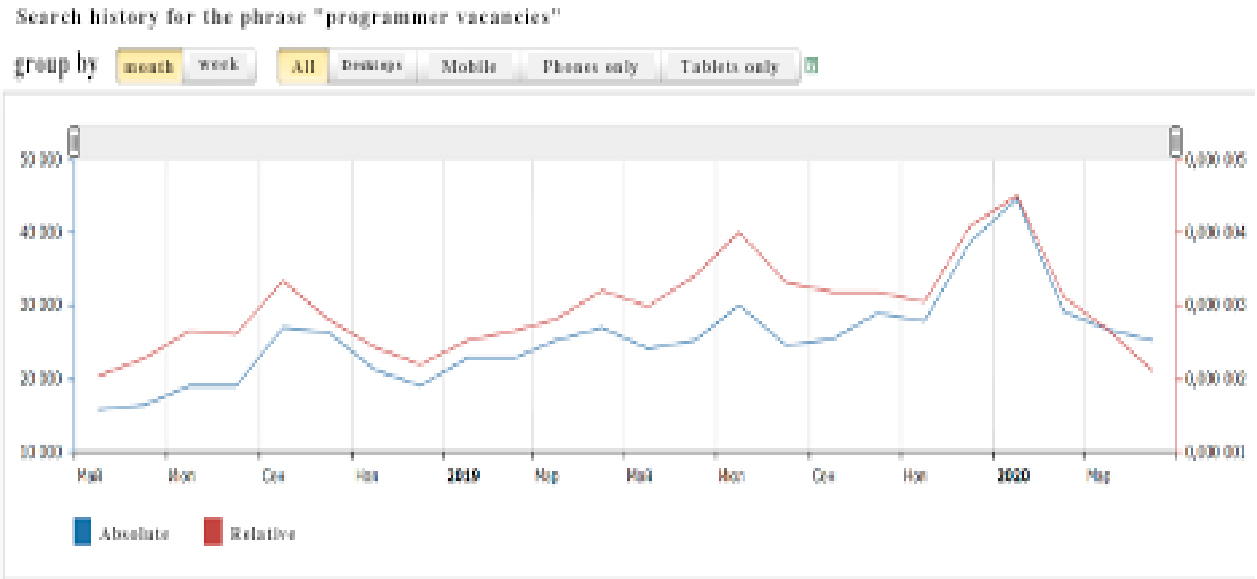


Figure 2. Request dynamics for "vacancy programmer" in Yandex

Based on the analysis of the dynamics of requests for the phrase "vacancy programmer" in the Russian-speaking area an increase of 200% can be observed by comparing data for January 2019 - 22,843 requests per month and January 2020 - 44,672 requests per month, however dynamics for May shows practically the same dynamics. Such a sharp decline may be associated with the pandemic that began in March. In general, there is an understanding that demand should be higher since many businesses have switched to online mode and the growth is expected, however, there is no confirmation of this yet despite that, the overall dynamics are positive.

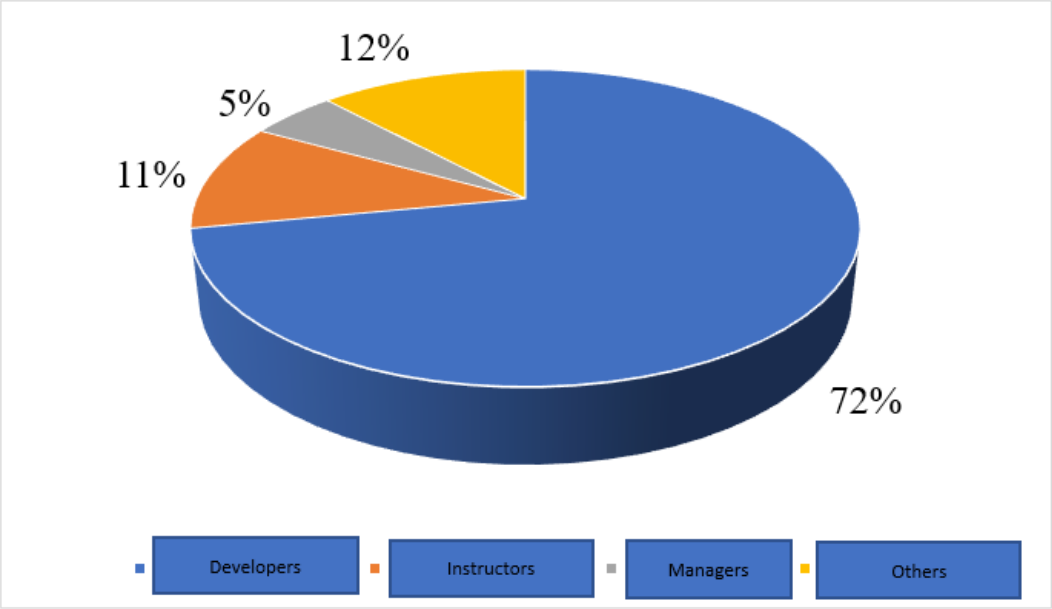


Figure 3. Number of vacancies by category according to the Telegram channel Job|DevKG

During the analysis of the Telegram channel Jobs | DevKG for the period from February 2020 to the end of April 2020, in two incomplete months 100 vacancies were examined. Detailed data on vacancies can be found in Appendix 3 of this report. Below is the distribution of vacancies for this Telegram channel by profession category.

Most of all job offers are received by programmers and software developers - almost 72%, 11% of vacancies were for teachers. 5% - for project managers.

In the same period, vacancies were analysed on the Jobs.kg website in the IT sector, here the picture is different and, apart from programmers (35%), the following specialists are in demand, i.e. digital marketing specialists (20%), 10% share of vacancies in project management, web design and sales, 8% targeting and SEO optimization and 7% others.

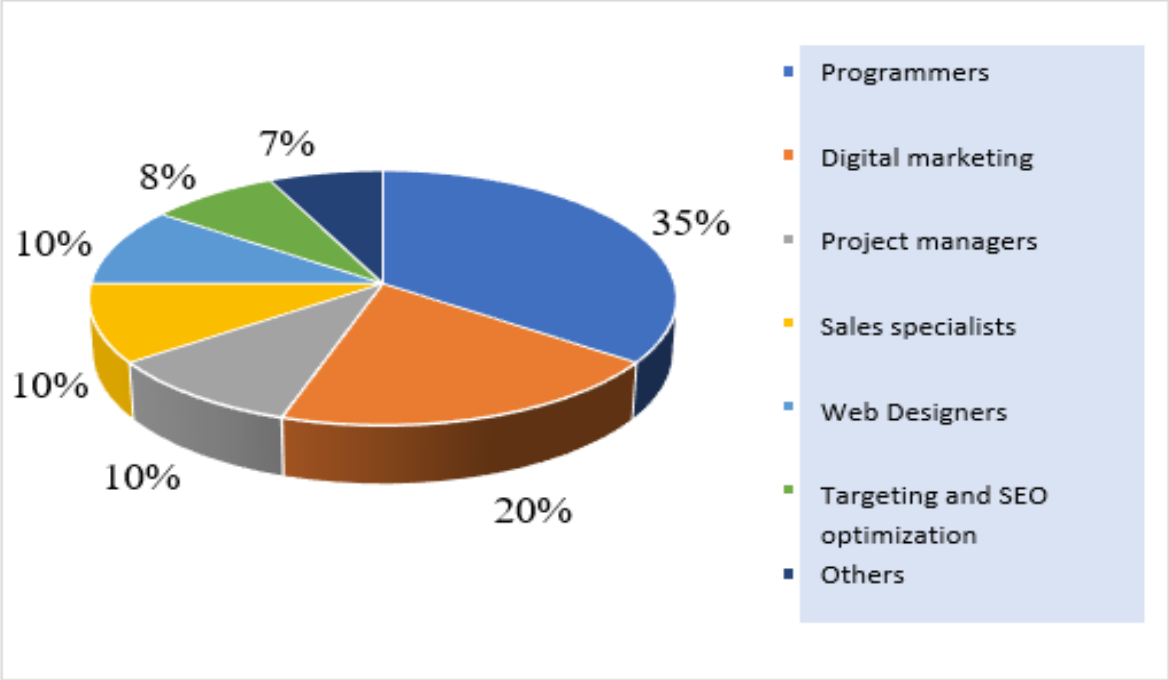


Figure 4. Demand for specialists on the job.kg website in the IT area (February 2020)

According to a survey of employers in Kyrgyzstan, the demand for IT specialists remains at the level of 40-70 positions per month that is more than 600 vacancies annually. At the same time, the demand for programmers for various sectors of the economy is always high that indicates the lack of qualified programmers on the market. The demand for big data and artificial intelligence specialists is still small, but demand is expected to increase in the future.

With regard to the salary of a programmer (developer), it depends on the experience of the IT specialist, the demand for the programming language and the skills that the specialist has.

Data provided in Appendix 3 collected from the dev.kg Telegram channel made it possible to form salary ranges: an IT specialist of an entry level (Junior level) can receive a salary from 300 to 600 USD per month; Middle-level IT specialist from $ 600 to $ 1000 per month; Senior IT professional can earn between $ 1,000 and $ 3,000 per month, with higher rates in some cases. [22].

According to surveys of IT executives, due to the lack of IT specialists in the Kyrgyz market, companies are constantly trying to tempt away software developers from other companies by offering higher salaries. As a result, the salaries of IT specialists are overestimated several times.

Demand forecast using the Holt-Winter model

"The Holt-Winter model is an extension of the Holt method. This method is characterized by three parameters to be selected in order to obtain a forecast" [29]. The choice of these parameters can be made by a simple picking over them in order to find the parameters at which the model most accurately repeats reality. Holt-Winter models can take into account the seasonality in a multiplicative manner.

"The formula is as follows

$$Yp(t + k) = [a(t) + kb(t)]F(t + k - L), \quad (2)$$

where

k - the lead period;

Yp (t) - the calculated value of the economic indicator for the t^{th} period;

a (t), b (t) and F (t) - model coefficients;

L – Period of the seasonality.

We calculate the exponentially smoothed series. We set the value k = 0.6, B = 0.9 and q = 0.5, and the seasonality coefficient for the first year was taken as 1. Using the coefficients, we calculated an exponentially smoothed series for our data. We have determined trend values for 2-year data. We estimate the seasonality.

E7 =F3*(D7-D6)+(1-F3)*E6

	A	B	C	D	E	F	G
1				seasonality coefficient for 1 year			1
2					k	B	q
3					0,6	0,9	0,5
4		Period	Demand	Lt	Tt	St-s	p
5		may.18	63	63		1,0000	
6		jun.18	66	64,8	1,6	1,0000	
7		jul.18	76	72,2	6,8	1,0000	
8		aug.18	76	77,2	5,2	1,0000	
9		sep.18	108	97,8	19,0	1,0000	
10		oct.18	106	110,3	13,2	1,0000	
11		nov.18	85	100,4	-7,6	1,0000	

Figure 5. Calculation of the seasonal component

To implement the Holt-Winter forecast, we specified 12 months from April 2020 to March 2021. In Figure 6 below, you can see that the demand data, exponentially smoothed series, and the forecast from the model estimate show adequate correlation.

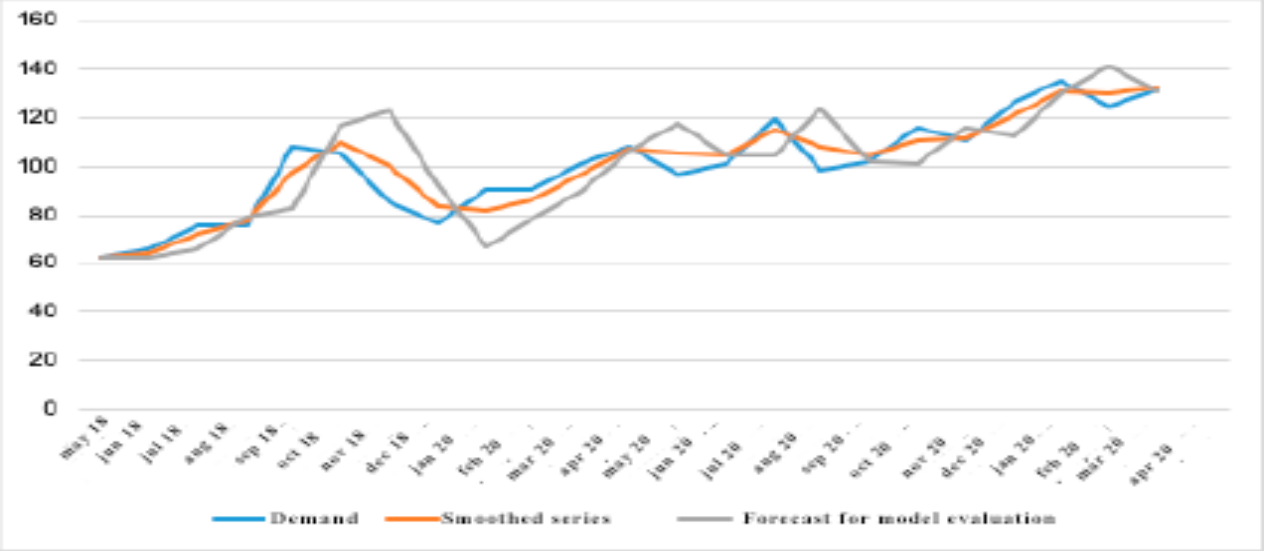


Figure 6. Prediction chart according to the Holt-Winter method

To assess the accuracy of the model, first, we calculated the forecast for the first period ahead for each month given that we know the demand data. To find the forecast estimates in the first and second years, it is necessary to sum the value of the exponentially smoothed series for the previous period and the trend value for the previous period.

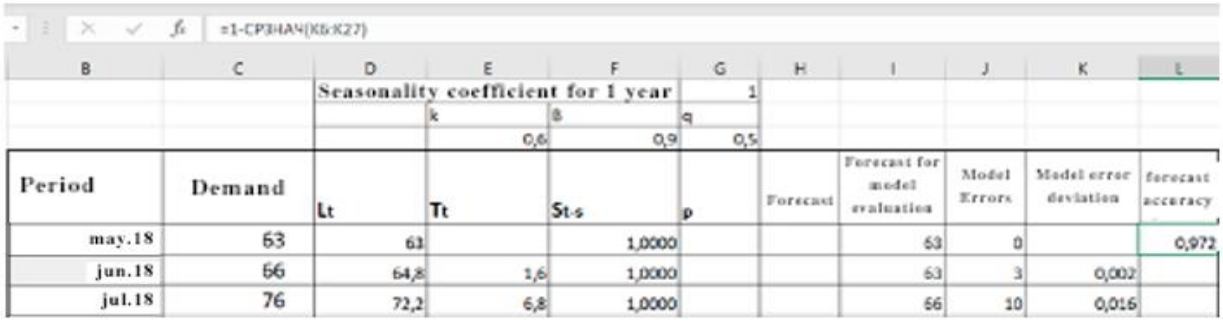
=D6+E6

	B	C	D	E	F	G	H	I
			Seasonality coefficient for 1 year			1		
				k	B	q		
				0,6	0,9	0,5		
	Period	Demand	Lt	Tt	St-s	p	Forecast	Forecast for model evaluation
	may.18	63	63		1,0000			63
	jun.18	66	64,8	1,6	1,0000			63
	jul.18	76	72,2	6,8	1,0000			66
	aug.18	76	77,2	5,2	1,0000			79
	sep.18	108	97,8	19,0	1,0000			82

Figure 7. Forecast for model evaluation

Next, we calculated the model errors, which have both positive and negative values. As a result, the model error gave us the basis for finding the deviation from the forecast model. We calculated the deviation of the model error from the forecast model by the ratio of the model

error squared to the actual squared value. All these actions made it possible to determine the forecast accuracy, which was 97.2%, which is as close as possible to 100%.



	B	C	D	E	F	G	H	I	J	K	L
			Seasonality coefficient for 1 year			1					
				k	ß	q					
				0,6	0,9	0,5					
	Period	Demand	Lt	Tt	St-s	p	Forecast	Forecast for model evaluation	Model Errors	Model error deviation	forecast accuracy
	may.18	63	63		1,0000			63	0		0,972
	jun.18	66	64,8	1,6	1,0000			63	3	0,002	
	jul.18	76	72,2	6,8	1,0000			66	10	0,016	

Figure 8. The accuracy of the forecast using the Holt-Winter model

Using the Holt-Winter method, we have calculated the predicted values shown in the table below. 1747 vacancies in this considered area are forecasted for 12 months.

Table 2. Demand forecast using the Holt-Winter method.

Period	Period number for forecast	Forecast
April 20	1	133
May 20	2	130
June 20	3	135
July 20	4	143
August 20	5	137
September20	6	143
October 20	7	151
November 20	8	150
December 20	9	156
January 21	10	157
February 21	11	154
March 21	12	159

The calculations allowed us to predict demand for 12 months using the Holt-Winter method; the coefficients we selected allowed us to achieve the highest forecast accuracy with the available data.

Table 3. Comparison of forecast results for the three models

Indicator	Trend projection method	Multiplicative model	Holt-Winter model
Significance level	54,67%	94,3%	97,2%
a_0	69,202	185,19	
b	2,6136	25,674	
k			0.6
b			0.9
q			0.5
Forecast	By the 2nd Quarter 2020 – 405 vacancies	4th Quarter - 1819 vacancies	12 months – 1747 vacancies

All three models can be used for time series analysis and demand forecasting, however, the demand projection model has a lower significance level and forecast period. This forecast gave us the opportunity to see the seasonal components of the demand for these professions, so in the multiplicative model, high demand is expected in the 4th quarter of the year, and in the Holt-Winter model, October and December show high demand, as well as July and January. As mentioned above, for the rest of the IT specialties, the data turned out to be insufficient for analysis and forecasting, since the demand for them is volatile and low.

Analysis of the supply of qualified personnel for digital professions in the Kyrgyz Republic

In general, labour supply does not depend on demand, as it is determined by demographic factors, individual education, employment and other interests. The labour supply is based on the active age population (AAP). The accepted level of economic activity of the population and the level of unemployment also determine the supply. Thus, the total supply of personnel in the labour market includes:

- Employed population of working age (in formal and informal workplaces) and its professional and qualification structures. Professions and qualifications are counted according to the position held, and not according to the level of professional education. There is also the potential to take into account all professional qualifications acquired in the past if the respondent claims to be able to engage in professional activities in these profiles,

• Unemployed population with professional qualifications and relevant work experience. Qualifications and work experience should be taken into account along with the respondent's declared interest in doing work in a specific profile,

• Recent graduates of institutions by profession and qualifications,

• Qualified migrants by profession and qualifications,

• Economically inactive working-age population that has valid (current) professional qualifications, work experience, and is able - at least to a certain extent - to return to work.

Table 4. Employment status of the working-age population in Kyrgyzstan (2018)

(Thousands of people)

Active Age Population (AAP)	Number of employed populations	Number of unemployed	Inactive population
3664.6	2382.5	156.3	1703.6

Table 5 provides information on the active age population by employment status, which can be used to predict future labour supply. Based on these data, it is also possible to show the level of economic activity (the ratio of employed and unemployed AAP) that is amounted to 65% in 2018. Since the majority of those employed in the labour force retain their jobs, short-term demand for expansion and demand for replacement of qualified workers is satisfied by an additional supply of skilled labour, the main source of which is:

- Recent graduates of universities and vocational education institutions who complete their training annually;
- Skilled unemployed in the labour force;
- Skilled migrants;
- Qualified, but economically inactive population who decided to return to the labour market.

Table 5 shows that a significant portion of the labour force derives its income from employment outside formal wage employment. Skilled workers can be either hired or self-employed. In Kyrgyzstan, only 30% of the workforce falls into the official reporting of enterprises.

Table 5. The structure of the employed in the labour force in Kyrgyzstan, 2018

Structure of employed population	Number, thousands of people	Share, %
Aggregate employment	2 382.5	100%
Employed in enterprises	696.8	29.20%
Employed by private individuals	813.4	34.10%
Small employers	31.8	1.30%
Self-employed	620.4	26%
Members of cooperatives	1.8	0.10%
Unpaid family workers	162.9	6.80%
Farmers	55.4	2.30%

Based on IT platforms and products, in addition to direct IT specialties and jobs (related to IT and programming), new supporting and non-technical professions and jobs are being created. According to the US Employment Multipliers Study, for one hundred IT jobs an additional 193.6 supportive jobs and 180.3 indirect (non-tech) jobs are created. The changes taking place in the field of employment in global markets include two main directions:

1) Reducing demand in professions;

2) Growing popularity of new technologies and services.

According to the data of the National Statistical Committee of the Kyrgyz Republic, in the structure of employment in the “Information and Communication” sector, employees with higher education (47.1%), secondary general education (21.4%) and secondary vocational education (16.3%) prevail [4 p. 26].

The Government of the Kyrgyz Republic has set a goal to achieve a 5% share of the digital economy in GDP in 5 years. According to cybersecurity expert Melissa Hathaway, the task set by the Government can be achieved only through "reforming the system of training IT specialists." According to our calculations, in 5 years it is required to prepare or train more than 700 thousand people in basic, intermediate and advanced digital skills, which will be 25% of the economically active population of the country by 2024.

Table 6 below shows that the number of graduates of higher professional education organizations is decreasing, thus, in 2016 there were 52.8 thousand graduates, then in 2018 only 33.1 thousand (37.3% lower than in 2016) graduates. In the same period, the organization of primary vocational education increased the number of graduates from 24.8 thousand to 33.3

thousand. In 2018, 94 thousand graduates graduated from all types of educational organizations in all types of vocational education.

Table 6. Graduates students of educational organizations by type for the period 2014-2018.

Name of indicators	2014	2015	2016	2017	2018
Graduated from 9 classes of basic education	91,4	90,7	89,0	89,9	91,8
Graduated from the secondary (full) educational organization (11 classes)	50,0	51,8	53,4	52,8	49,8
Educational organizations of primary vocational education	25,5	25,7	24,8	29,8	33,3
Educational organizations of secondary vocational education	23,0	27,1	28,7	27,0	27,6
Educational organizations of higher professional education	40,8	41,7	52,8	48,9	33,1

At the same time, although the number of graduates in IT specialties is generally growing, the number of certified IT specialists who graduate from universities is decreasing every year. According to a study carried out by the Soros Foundation Kyrgyzstan, about 7,400 specialists graduate from educational institutions of the country, including private short-term training courses, in technical specialties every year [3]. Taking into account the potential demand for 926 vacancies in the period from 02.2019 to 02.2020, there should be an excess of personnel, however, according to the survey of employers, the demand is high and there is not enough qualified personnel.

Table 7. Modelling the demand deficit by scenarios in the academic year 2020-2021.

Growth rate of IT sector	38%	30%	20%	10%	5%
Potential Demand for IT Professionals	10678	8430	5620	2810	1405
Demand for supportive jobs (IT-related)	20673	16320	10880	5440	2720
Graduation per year (HEIs, Vocational education, courses)	7500	7500	7500	7500	7500
Difference	-23851	-17250	-9000	-750	3375

Thus, if we assess the potential demand for 2020 and supply, we can see that the demand will be covered only in the case of a 5% growth rate of the IT sector. Any other scenario will require additional training of qualified personnel.

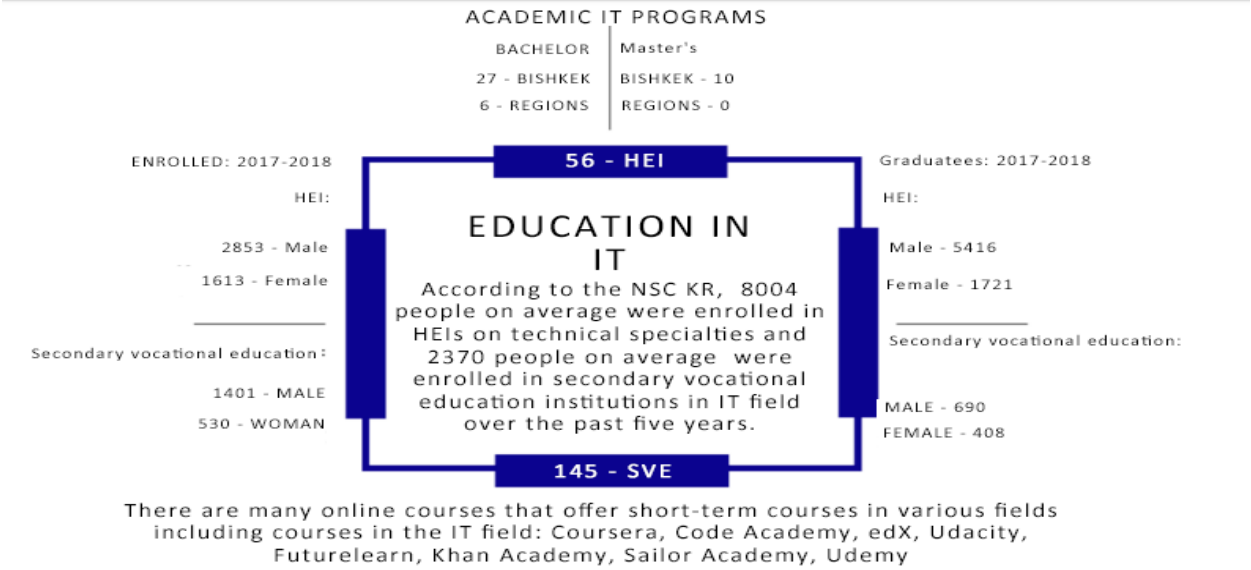


Figure 9. IT Education - Total Number of IT Graduates

According to the data of the Ministry of Education and Science of the Kyrgyz Republic (MES KR) as of October 2018, 43 academic programs of undergraduate and graduate levels in the direction of "Information and Communication" are presented in 16 universities of Kyrgyzstan. In addition to formal education, it should be noted short-term courses in IT areas, which are provided by private educational institutions, such as DevCIT Training Centre at AUCA, Attractor School, IT Academy at Kyrgyz Association of Software Developers and Services. According to one of the representatives of private courses, the number of students graduating from their programs is 300-400 people a year. According to the respondents, the number of graduates of the other two large companies is approximately 250 people. In total, these three companies alone produce about 1000 people. In addition to large educational institutions, there are a large number of other companies offering courses in IT areas - more than 60 small and medium-sized companies [24]. Thus, short-term courses from private educational companies are one of the most popular ways to acquire digital skills in the IT field. Thus, in order to train 700 thousand citizens in the Kyrgyz Republic by 2024 in digital skills, efforts will be required by not only existing professional education organizations, but also by the active involvement of providers of additional and continuing education.

The analysis of the labour market shows that today the efforts of employers are aimed at finding experienced (ready-made) specialists, if there are none on the market, then their efforts are

aimed at “retraining and improving the qualifications of only highly qualified and valuable workers” [16] of their company. Start-up companies (start-ups), due to the cheapness of the labour force, mainly take young and inexperienced university graduates.

Implementing demand-driven curricula defined by the digital economy

Labour market change

As part of event 1.1 of the project "Digital Skills and Employment Opportunities for Youth in the Digital Economy in the Kyrgyz Republic", an assessment of the current situation was initiated and a desk study was conducted on the analytical reports of local project experts and third-party organizations including ILO, DCASA, USAID, SDC, ADB, Kyrgyz-Russian Development Fund and programs and regulations of the Kyrgyz Republic. IT executives were interviewed to assess the level of digital literacy.

The digital economy is involved in global sectors of the economy that have a significant impact on the labour market:

- Creation of a significant number of new professions
- Widening the skills and knowledge gap
- Accelerating the pace of technology development.

The World Economic Forum's Policy Brief “The Future of Jobs” states that 35% of today's job market skills will change within 5 years. The digitalization of the economy will change the structure of the workforce. Therefore, according to an international study, if by 2020 only 3% of jobs will be automated and replaced by the use of robots or other "smart" systems, then by the end of the 2020s this figure will have increased up to 20%, and by the mid-2030s years up to 30%. For the development of the digital economy and the harmonious entry of Kyrgyzstan into global markets, four technical factors are required:

- Ubiquitously available high-speed mobile Internet;
- Artificial intelligence technologies;
- Tools and specialists in big data analysis;
- Widespread use of "cloud" technologies.

The changes taking place in the sphere of employment in the global markets include two main directions:

1) Reducing demand for certain professions; at the same time, the universities of Kyrgyzstan continue to produce specialists, the need for which has practically vanished in the current market conditions; the leadership of universities also points to an outdated classifier of professions, which does not allow opening new directions in demanded specialties;

2) Growing popularity of new products and services due to the introduction of new technologies and other socio-economic changes; developers of new products and services are ready to conduct free training / retraining of specialists, however, universities (formal education) cannot adapt such courses and training of specialists is carried out in the form of non-formal education. In a conversation with the dean of the FIT KSTU Kabaeva G. Zh., it was mentioned "the faculty is now studying what specialists are required through job sites and we plan to teach in broad areas such as artificial intelligence, big data ...». It should be emphasized that the current demand for specialists is not predetermining, since in 4-8 years the labour market will change due to the intensive development of the digital economy. In addition, training in broad specialties can lead to the current situation when graduates know enough about the specialty as a whole, but cannot apply knowledge in a specific organization due to the lack of narrow specialization in the profile. Foreign universities solve these issues through the possibility of choosing in each direction (major) a narrower specialization (minor), which will most fully meet the needs of a particular student, based on his interests and desires.

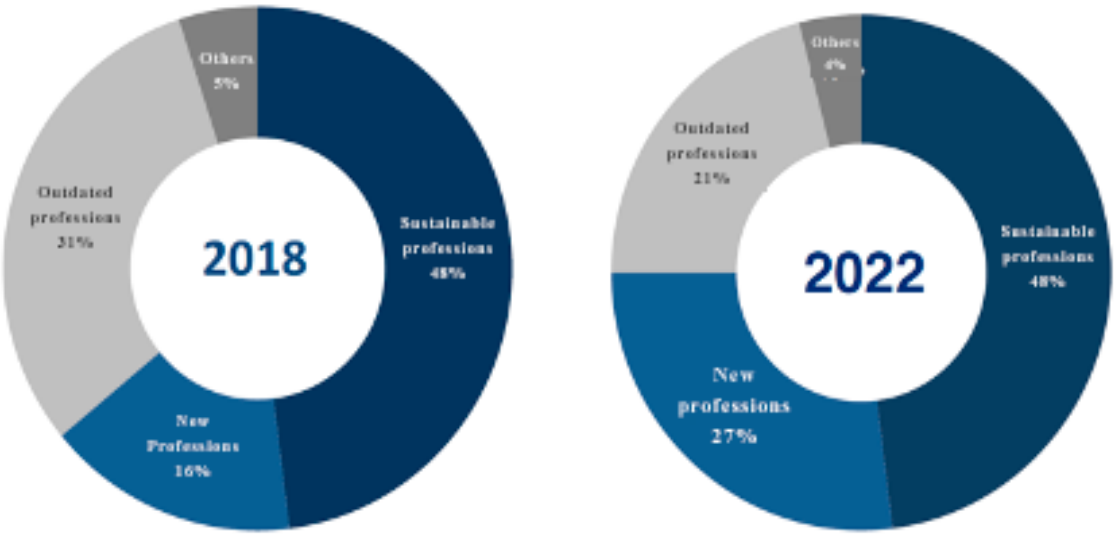


Figure 10. Comparison of the shares of new and obsolete occupations in 2018 and 2022.

It is recommended to revise the approach to the choice of a specialty, taking into account the delayed demand in the labour market (4-8 years) and introduce the possibility of a specialty through elective courses. For example, with a degree in IT security, you can choose elective courses and get a specialist in IT security in banking, cybersecurity, or IT audit.

Assessment of the current level of digital skills in Kyrgyzstan

According to the National Statistics Committee of the Kyrgyz Republic, employees with higher education (47.1%), secondary general (21.4%) and secondary vocational (16.3%) prevail in the structure of employment in the “Information and Communication” sector.

Interviewing of experts

In February 2020, a survey of IT experts and business leaders was conducted to identify the digital skills divide. Ten experts rated the digital skills of three categories of workers in each of the sectors of the Kyrgyz economy on a scale of 1 to 10.

Table 8. Assessment of current digital skills of employees of organizations of the Kyrgyz Republic

Economy sectors	Workers - Basic Skills	Specialists - Intermediate Skills	Leaders - Advanced Skills
Agriculture, forestry and fishing	10%	3%	0%
Mining	10%	30%	10%
Services	20%	30%	10%
Public health and social services	30%	30%	20%
Transport activities and storage of goods	10%	20%	20%
Trade	25%	30%	20%
Education and Science	40%	20%	15%
Building	10%	20%	30%
State and municipal administration	20%	30%	20%
Production	10%	40%	30%
Finance and insurance	50%	40%	40%
Information and communication	70%	40%	40%

The Government of the Kyrgyz Republic has set a goal to achieve a 5% share of the digital economy in GDP in 5 years. According to cybersecurity expert Melissa Hathaway, the task set by the Government can be achieved only through "reforming the system of training IT specialists."

The international consultant made calculations according to which it is required to prepare or train more than 700 thousand people in basic, intermediate and advanced digital skills in 5 years, which will make up 25% of the economically active population of the country by 2024.

During the interviews, 10 experts made a forecast on a scale from one to ten on the required level of digital skills for three categories of workers in each of the sectors of the Kyrgyz economy for 2024 to achieve an increase in the integration of IT technologies and industries.

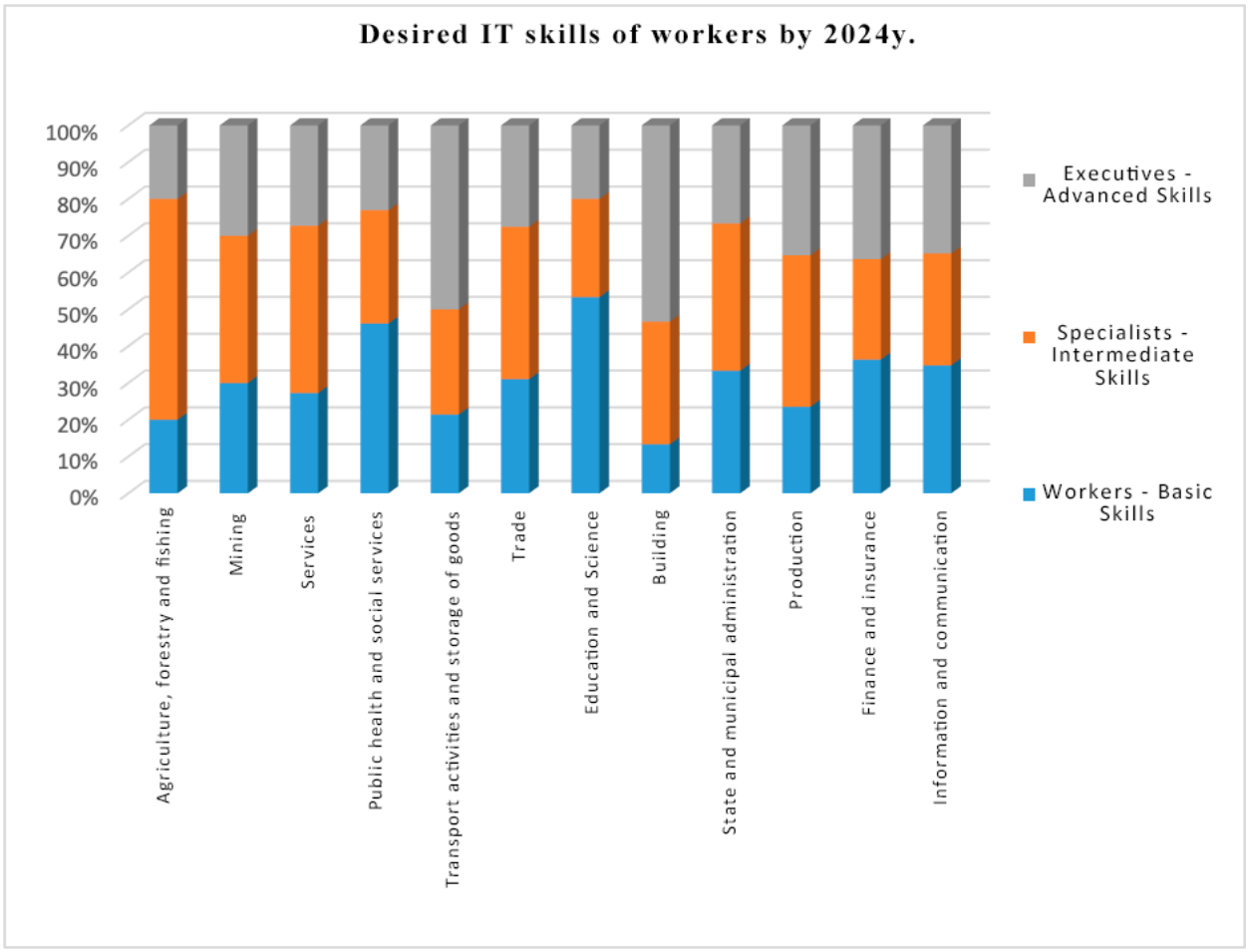


Figure 11. IT Skills Levels by Three Worker Categories by 2024

Major trends in digital technologies

The World Economic Forum's Policy Brief “The Future of Jobs” states that 35% of today's job market skills will change within 5 years [16]. The digitalization of the economy will change the structure of the workforce. So, according to an international study, if by 2020 only 3% of jobs will be automated and replaced by the use of robots or other "smart" systems, then by the end of the 2020s this figure will have increased to 20%, and by the mid-2030s years up to 30% [10].

According to the analysis of expert materials, three blocks of digital professions are drawn:

Internet Marketing: Internet Marketer (Universal), SMM Manager, Content Marketer, Community Manager, Copywriter, Email Marketer, Target specialist, contextual advertising Specialist, Web Analyst, SEO Specialist.

Internet professions: Internet marketing, digital product management (project manager, product manager, product designer), web designer, web development, game design.

Data Science is at the intersection of IT and digital professions: on the one hand, it requires the skills of a mathematician-programmer, on the other, the ability to optimize processes, influencing the company's strategy.

The International Telecommunication Union (ITU) in 2018 presented 10 of the newest and oldest professions in the ICT sector. The trend was compiled based on information on recruiting specialists in the period between 2013-2017. At the same time, I would also like to draw attention to anti-trends, those professions for which the offer was negative and they were attributed to obsolete professions.

The Kyrgyz Republic significantly lags behind technologically developed countries, but despite this, the presence of international organizations and global trends also shows a similar trend in the modern labour market in Kyrgyzstan.

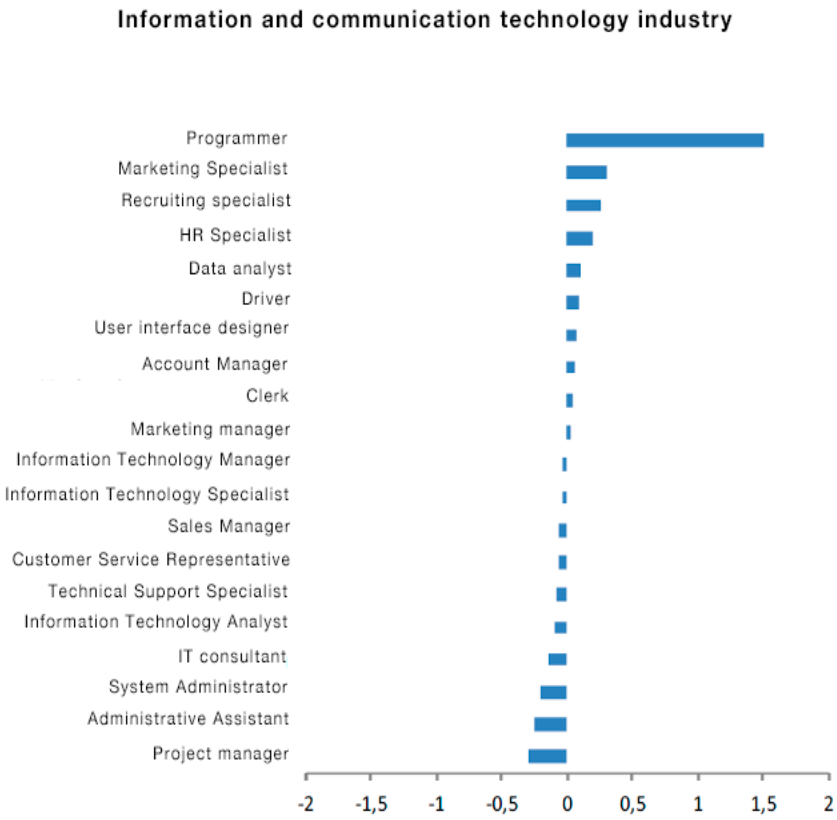


Figure 12. Ten newest and outdated occupations in the ICT sector according to hiring trend between 2013-2017

The USAID project study also paid great attention to identifying trends in terms of technologies that could be developed in Kyrgyzstan. The vision of the interviewees coincides with the main trends in the IT field. Figure 13 shows the "Percentage of Observations" - the response rate as a percentage, since this was a multiple response question. The highest response rate was gained by mobile game and app development (14.1%), back-end and front-end (11.7% and 11.5%, respectively), big data (11.2%), artificial intelligence (9, 5%), Internet of Things (6.1%), block chain and finance (5.1%), machine learning (7.3%), AR / VR (4.9%) and others (1.5%).

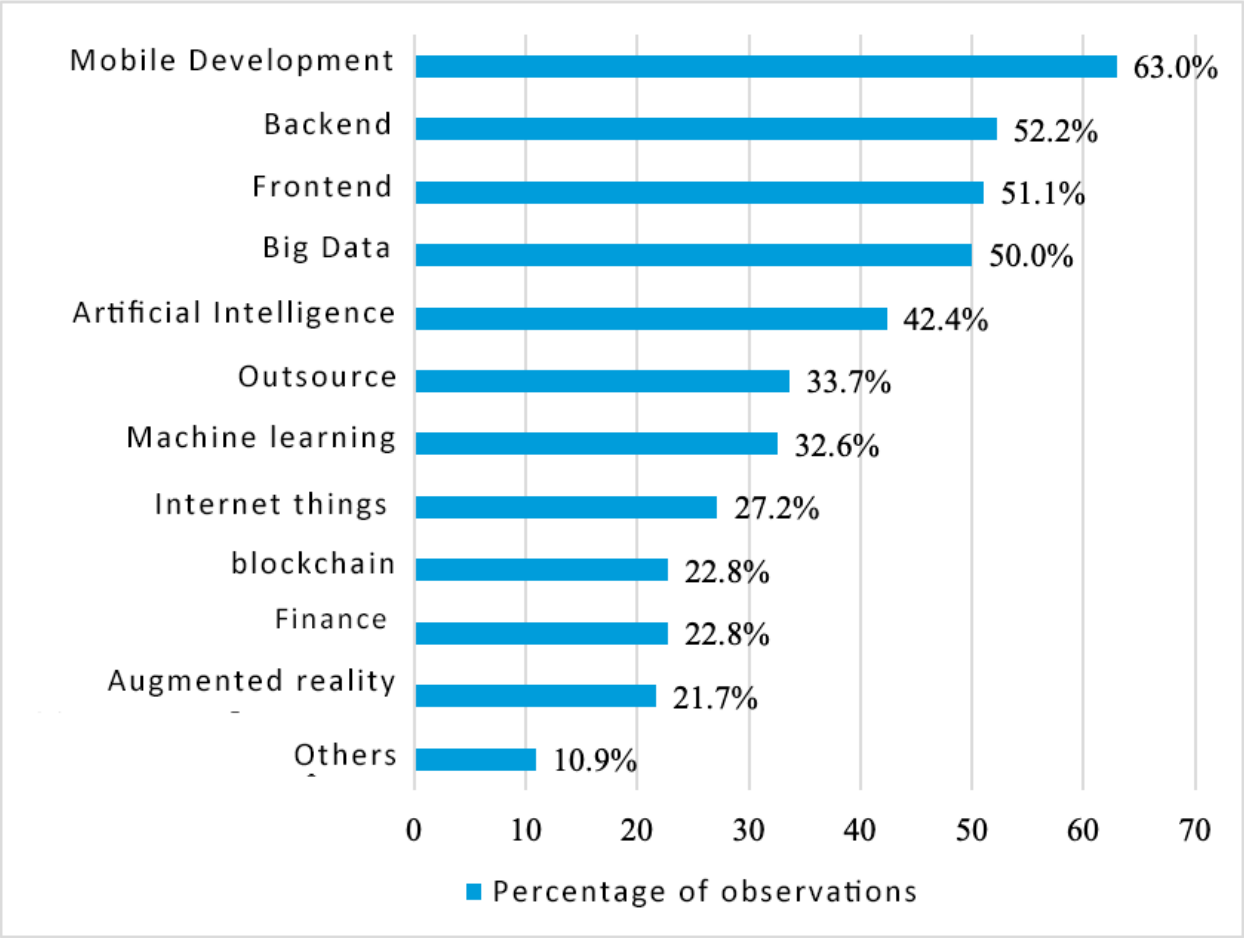


Figure 13. Trends by technology for Kyrgyzstan according to USAID survey respondents.

Such directions as game designer, web analyst, software tester, Internet marketer, contextual advertising specialist, SEO specialist, SMM specialist did not get into trends.

Different programming languages are used for software development in different sectors. Programming languages can be classified into high-level and low-level. High-level languages are abstractions designed for speed and ease of use by the programmer. They are used for data processing, game development, creating social networks, messengers. High-level languages include Python, JavaScript, C #, Java, JavaScript, PHP, Ruby, Perl, Golang. Programming languages at this level are easier to learn.

Low-level programming languages are close to machine code (machine-oriented programming languages). They are suitable for developing new operating systems or writing code for microcontrollers. Such languages need to be learned at universities, since learning a low-level

language is quite difficult. There is less demand for them, but wages are much higher. Low-level languages include Assembler, CIL, used in the Microsoft .NET platform, C, C ++.

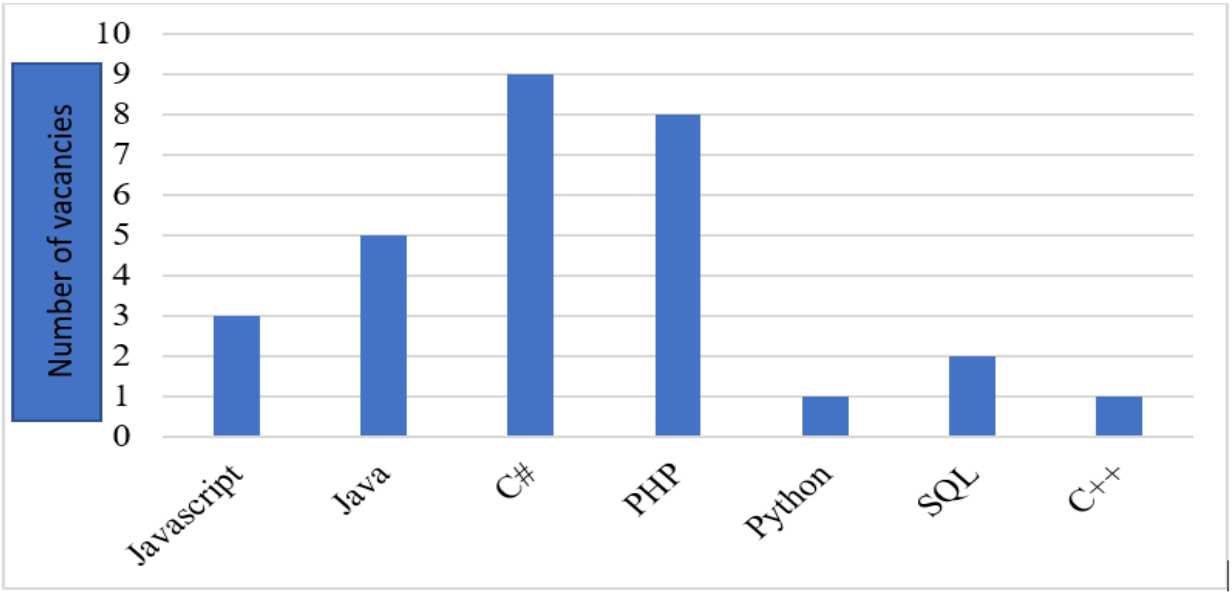


Figure 14. Demand for programming languages

According to the survey respondents, the most popular programming languages in the Kyrgyz Republic are JavaScript (23.9%) and Python (21.4%). Java (15.1%), C # (13.4%) and PHP (10.9%). By the number of participants, it can be assumed that these languages are the most common among the developers of Kyrgyzstan.

Education and ICT Sector Challenges

The respondents of this study were unanimous in expressing the most pressing problem - the lack of human resources, as well as the outflow of experienced young specialists to foreign countries due to the more attractive conditions offered there. There is a remarkable fact is that specialists gain experience and improve their qualifications in the country, and as soon as they become owners of a high level of professionalism, they leave for other countries. Thus, local companies lose valuable specialists and they have to look for new ones, and most often train new employees on their own.

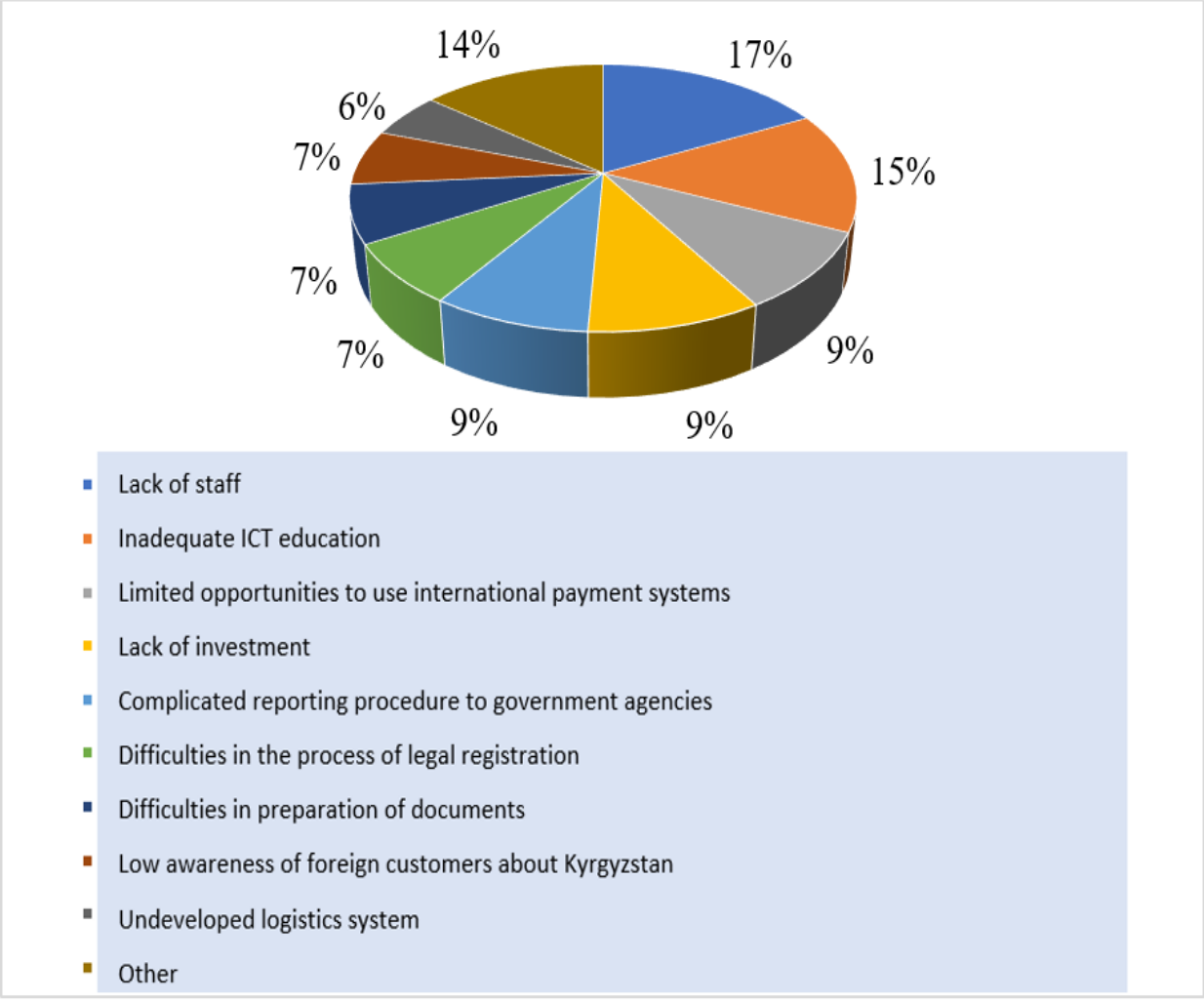


Figure 15. Identified problems in the IT subsectors of the Kyrgyz economy (USAID research)

1. Lack / turnover of staff

USAID project respondents from all subsectors were unanimous in expressing the most pressing problem in their field. This problem is the lack of human resources, as well as the outflow of experienced young specialists to foreign countries due to the more attractive conditions offered there. There is a remarkable fact is that specialists gain experience and improve their qualifications locally, and as soon as they become owners of a high level of professionalism, they leave for other countries. Thus, local companies lose valuable specialists and they have to look for new ones, and most often train new employees on their own.

2. Inadequate ICT education

The respondents emphasized the insufficiently high level of education in the IT sphere. Only graduates of some universities come with the knowledge necessary for work.

3. Limited opportunities to use international payment systems

Representatives from various subsectors mentioned that they face difficulties in using financial services, in particular electronic payment systems.

4. Lack of investment

To open and develop a business in certain subsectors, an impressive financial investment is required. These companies have problems accessing investment capital. Especially software publishing, game development, e-commerce companies.

5. Difficulties in the process of legal registration

One of the difficulties that IT companies and freelancers face is the process of legally registering their activities. Respondents mentioned that it takes quite a long time to register and visit several government agencies. In addition, some of the respondents mentioned that they sometimes do not know how to classify their activities into categories of activities available for voluntary patenting.

6. Difficulties in preparation of documents

In the case of freelancers, receiving an order on electronic job search platforms (Upwork.com), the parties do not even enter into an agreement (the platform administration is the guarantor of payment and the regulator of their relationship with the customer). This is why it is difficult to disclose and confirm their income.

7. Low awareness of foreign customers about Kyrgyzstan

Foreign customers are not aware of Kyrgyzstan as a country of IT outsourcing. Kyrgyzstan is not included in such indices and ratings as AT Kearney Global Services Location Index, Software Magazine Software 500 Rating, and Clutch.co

8. Undeveloped logistics system

Limiting the possibility of exporting goods produced in Kyrgyzstan with delivery to retail buyers.

Among other significant problems, the respondents listed:

9. Limited number of IT teachers

This problem is the cause and consequence of the problems associated with poor quality education in the IT sector.

10. Insufficient level of knowledge of English

The respondents participating in the study mentioned the language difficulties that some specialists face in the process of work.

As part of the Soros project research, respondents from the education sector were interviewed. According to the collected data, the difficulties of representatives of this area were identified:

- Lack of staff (teachers) / Low qualification of the academic staff;
- Lack of equipment / programs in state universities, which leads to an underestimated quality of education;
- Decreasing number of incoming applicants;
- Low number of graduating students5.

Development strategies of FIT KSTU

The terms of reference indicated an assessment of the existing potential of the Kyrgyz State Technical University (KSTU). After examining the documents provided by the KSTU n.a. I. Razzakov, it was recommended to change the approaches to the implementation of formal education.

[5] Analysis of the Information Technology Sector in the Kyrgyz Republic. USAID Competitive Enterprises Project, Bishkek, 2019.

To implement the tasks outlined in the Concept of digital transformation of the Kyrgyz Republic before universities, in particular, KSTU named after I. Razzakov is faced with the task of radically restructuring the training system for IT specialists (Faculty of Information Technologies, FIT), in order to meet the growing demand for highly qualified IT specialists.

Faculty of Information Technology (FIT) KSTU named after I. Razzakov consists of the following graduating departments:

- Department of "Automatic control" (AC) - provides training in the direction 700200 - "Control in technical systems" (full-time and part-time education), qualification - bachelor, master; Internet technologies and management 710500- "Internet technologies and management", (full-time and part-time education), qualification - bachelor;
- Department of "Informatics and Computer Engineering" (ICE) - provides training in full-time education on the basis of secondary, professional, higher education: bachelors and masters of engineering and technology in the direction 710100 - "Informatics and Computer Engineering" of engineers in the specialty 590001 - "Information security ", masters in the experimental direction" Informatics and programming technology "(within the TEMPUS project).
- Department of "Software for Computer Systems" (SCS) - provides training in full-time education based on secondary, professional, higher education: bachelors and masters in the direction 710400 "Software Engineering"; bachelors and masters in the direction 590100 "Information Security".
- Department of Applied Mathematics and Informatics (AMI) - provides training in full-time education on the basis of secondary, professional, higher education: bachelors and masters in the direction 510200 "Applied Mathematics and Informatics", bachelors in the direction 580500 "Business Informatics"

More than 1000 students study at the IT faculty. FIT graduates work in IT companies, in academic, industry and commercial structures of the Kyrgyz Republic and outside the Republic.

Working curricula for training bachelors at the FIT KSTU named after I. Razzakov were built according to the state educational standards (SES) of the HPE of the Kyrgyz Republic. The total labour intensity of mastering of the main educational program in HPE for bachelor training is 240

ECTS credits (7200 hours). The complexity of one academic semester is, as a rule, 30 ECTS credits (90 hours). Each cycle of disciplines has a basic (compulsory) part and a specialized one set by the university. The profile part makes it possible to expand or deepen knowledge, skills and abilities determined by the content of the basic disciplines, allows the student to continue education at the next level of HPE to obtain an academic degree "Master" in accordance with the profile received.

The profile part consists of two parts: the university component and the discipline of the students' choice.

Table 9. SES HPE in the direction 590100 "Information security".

Humanitarian, social and economic cycle	30-40 credits	13%-17%
Mathematical and natural science cycle	30-50 credits	13%-21%
Professional cycle	130-140 credits	54-58%
Educational and industrial practice and (or) pre-qualification practice	12-15 credits	5%-6%
Final state certification	12 -15 credits	5%-6%
The total labour intensity of the main educational program	240 credits	100%

Table 10. SES HPE in the direction: 580500 "Business Informatics"

Humanitarian, social and economic cycle	36 credits	15%
Mathematical and natural science cycle	37 credits	15%
Professional cycle	140 credits	58%
Educational and industrial practice and (or) pre-qualification practice	15 credits	6%
Final state certification	12 credits	5%
The total labour intensity of the main educational program	240 credits	100%

Table 11. SES HPE in the direction 700200 "Management in technical systems",

Humanitarian, social and economic cycle	32-42	13%--18%
Mathematical and natural science cycle	40-45	17%--19%
Professional cycle	135-145	56%-60%
Educational and industrial practice and (or) pre-qualification practice	10-15	4%-6%
Final state certification	10-15	4%-6%
The total labour intensity of the main educational program	240	100%

Table 12. SES HPE in the direction 710500 "Internet technologies and management"

Humanitarian, social and economic cycle	27-37	11%--15%
Mathematical and natural science cycle	42-65	18%--27%
Professional cycle	115-133	48%-55%
Educational and industrial practice and (or) pre-qualification practice	10-17	4%-6%
Final state certification	6-8	4%-7%
The total labour intensity of the main educational program	240	100%

Table 13. SES HPE in the direction: 710100 "Informatics and computer technology"

Humanitarian, social and economic cycle	32-42	13%--18%
Mathematical and natural science cycle	40-45	17%--19%
Professional cycle	134-138	56%-60%
Educational and industrial practice and (or) pre-qualification practice	10-15	4%-6%
Final state certification	10-15	4%-6%
The total labour intensity of the main educational program	240	100%

Table 14. SES HPE in the direction: 710400 "Software Engineering"

Humanitarian, social and economic cycle	30-40	13%-17%
Mathematical and natural science cycle	30-50	13%-21%
Professional cycle	120-140	54-58%
Educational and industrial practice and (or) pre-qualification practice	12-15	5%-6%
Final state certification	12-15	5%-6%
The total labour intensity of the main educational program	240	100%

Table 15. SES HPE in the direction: 510200 "Applied Mathematics and Informatics"

Humanitarian, social and economic cycle	36-42	15%-18%
Mathematical and natural science cycle	70-80	29%-33%
Professional cycle	112-132	47%-55%
Educational and industrial practice and (or) pre-qualification practice	15-18	6%-8%
Final state certification	4-6	2%-3%-
The total labour intensity of the main educational program	240	100%

In accordance with the current State Educational Institution of Higher Professional Education of the Kyrgyz Republic, for which the current Working curricula for training bachelors in IT areas have been developed, the labour intensity of the Professional cycle does not exceed 60% of the Total labour intensity of the main educational program, and at the same time the basic (unchanged) part is 50% of the number of credits of the Professional cycle , which ultimately entails the obsolescence of educational programs and the lag in the level of training of university graduates from the requirements of the IT market.

Instructors of the professional cycle, as a rule, must have an academic degree of candidate, doctor of science and (or) experience in the relevant professional field. The share of teachers with a candidate or doctor of science degree in the total number of teachers who provide the educational process in this general educational program must be at least 35%.

Recommendations for improving the training of FIT students:

- Develop new curricula in IT areas with the inclusion of innovative approaches to training and certification courses.
- Within the framework of the Centre for Innovation for Cooperation (CIS) of KSTU, organize training and industrial practices based on business IT companies and employers.
- Within the framework of research work, carry out orders for the development of software and other developments under the guidance of teachers at the graduating departments.
- Within the framework of coursework and diploma works, provide for the opportunity to carry them out for employers with the support of the employer's specialists.

These recommendations will make it possible to involve active specialists and experts in the educational process. To comply with the requirements (up to 20%) for the number of teachers with a candidate or doctor of science degree, in the total number of teachers who provide the educational process in the main education program cycles, it is needed to consider professional certifications and foreign diplomas in accordance with scientific degrees, and also take into account the length of service in the specialty.

Soft skills

Interviews with experts and company leaders also highlighted the importance of soft skills or 21st century skills. Some managers indicated that they are ready to hire a graduate with weak technical skills, but if his communication skills are at a high level. Since, according to managers, it is easier to teach the required technical skills in the workplace than to instil communication skills.

During the focus groups with the teachers of KSTU, the international expert had the opportunity to find out the teachers' opinion on the "soft skills". One of the professors expressed the general opinion that the main thing is to give fundamental knowledge, and these skills are not particularly important and to devote time to them in the curriculum is a “waste of time”.

What are “soft skills” in general? These are personal characteristics that help (or hinder) graduates to interact constructively with the external environment. Experts on "soft skills" often cite examples of a programmer who chews his lunch in the workplace, does not speak to anyone in the elevator, but says a few words at a meeting. This becomes a problem for company leaders, since such a programmer is not able to cooperate with a colleague in the implementation or development of a project. In companies, employees (project managers) appear who become a layer between programmers and customers. Soft skills help programmers become real team players. They are responsible for the quality of interaction, communication, cooperation.

Soft skills that ensure successful interaction with the team become mandatory for any position. Candidates for IT vacancies can no longer do without the ability to competently build teamwork, solve various related problems and achieve the implementation of their ideas.

According to a World Economic Forum report, XXI century skills are composed of three “foundations”: fundamental skills, skills, and personality traits (see figure below). Sometimes 21st century skills are referred to as "communication skills."

As shown in the illustration, digital skills (called “ICT literacy” in the chart) are categorized as fundamental. This underlines the great importance of the link between digital skills and other skills and personality traits - all of which should be considered in the overall system of continuing education or lifelong learning.

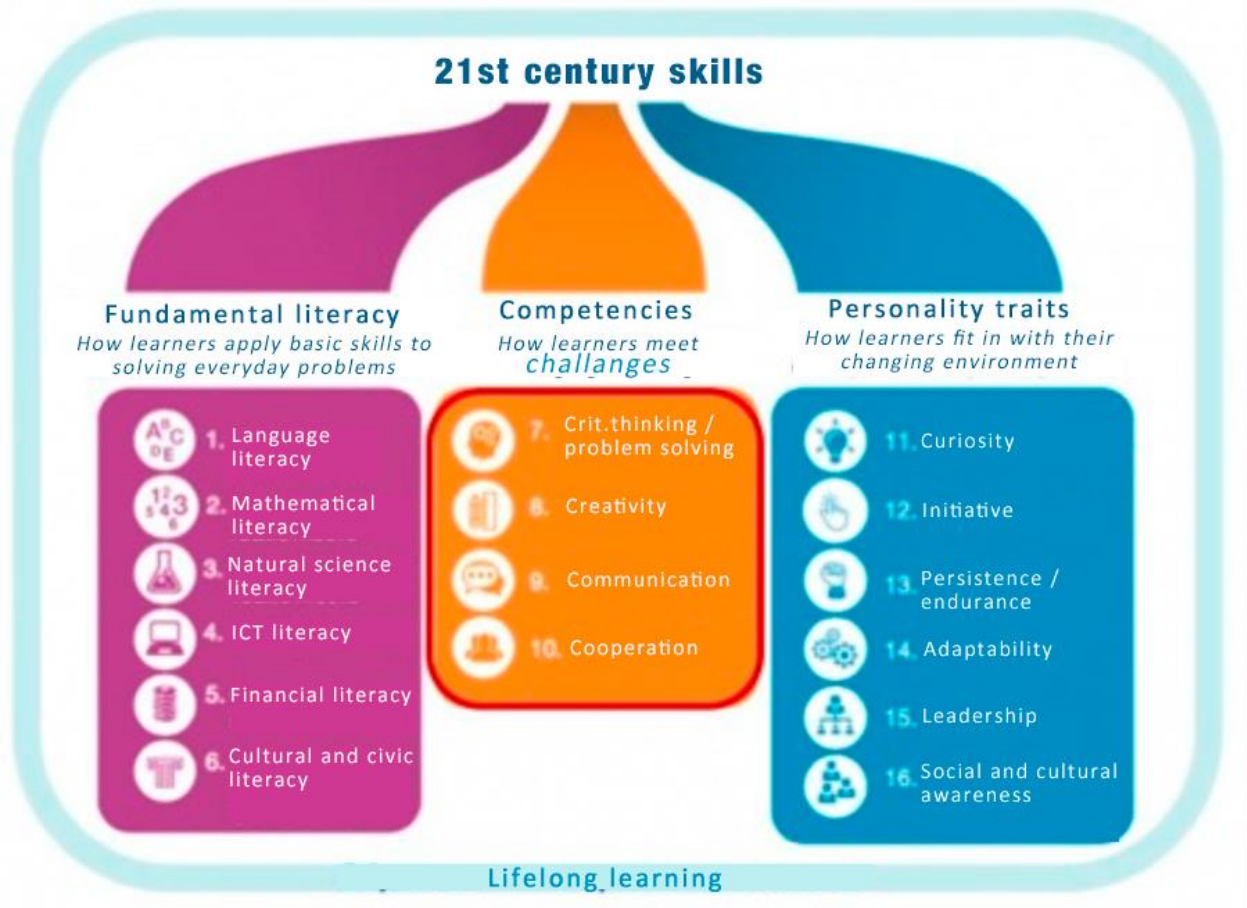


Figure 1. XXI century skills

Learning management system

Education 1.0 - 5.0

The transition from digital skills training version 1.0 to version 3.0 is possible in the near future.

What does digital skills 1.0 mean, and how many are there?

Today there are five versions.

Digital Skills Teaching Version 1.0 refers to a teacher / educator dictate approach. Here the model looks like this:

1. Listen to the teacher;
2. Answer questions, read teaching materials;
3. Perform tasks on the computer.

This is a standard behaviouristic type of education, when all students study according to the same standard, regardless of their level of knowledge and interests.

Digital Skills Training 2.0 stands for a collaborative approach. Here the model looks like this:

1. Listen to the teacher;
2. Ask questions, read educational and additional materials;
3. Work on complex assignments in small groups.

This is a constructivist type of education, when all students study according to a single standard, but depending on their level of knowledge and interests, the program varies through elective courses, independent work with teachers (IWI) and work on their own projects.

Digital Skills Training 3.0 stands for a blended approach. Here the model looks like this:

1. Listen to the teacher's online lectures;
2. Independent work with instructor, ask questions and solve problem-oriented learning;
3. Work on real-world assignments using blogs, podcasts and related engagement (interaction) technologies.

This is a blended type of education, when the educational standard dictates only the compulsory part of the curriculum, and students, depending on their level of knowledge and interests, choose their own learning path.

Digital Skills Training 4.0 stands for an online approach. Here the model looks like this:

1. Online lectures by the teacher and video materials of specialists on the Internet;
2. Online work in teams on platforms;
3. Work on their own projects using blogs, podcasts and related technologies of student participation (interaction).

This is an online type of education, when there is no single educational standard and one university, and students, depending on their level of knowledge and interests, choose their own learning path from any educational service provider. The type of diploma or graduation document depends on the completion of the workload and the emphasis is on the certification of professional skills.

Digital Skills Training 5.0 stands for an Artificial intelligence-based approach. Here the model looks like this:

1. Artificial intelligence creates a unique profile for each student based on the history of interests. This educational profile will search for materials (lectures and assignments) by tags and provide the most relevant results to the student;

2. In social networks, students can create groups to work on projects with like-minded people.

This is a smart type of education, when students, depending on their level of knowledge and interests, receive technology based on artificial intelligence, which allows them to implement their creative projects. Professional certification and protection of creative projects will be required.

To achieve the level of digital skills that allow creating sectors involved in the digital economy, it is necessary not only to create infrastructure, but also to train a critical mass of the country's population so that a sufficient number of specialists with the required level of knowledge and skills in the field of computer technologies appear.

Correct implementation of approaches 2.0 and 3.0 in the education system will bring the level of qualifications of graduates of the IT higher education system to meet the requirements of employers. In general, employers are not confident in the ability of educational institutions to prepare the appropriate workforce, so the data on the graduation of students over the past 3 years confirms the downward trend, when higher education becomes less and less relevant in the IT market.

The communication vacuum is growing between IT education providers in the higher education system and IT companies. It is necessary to take into account the needs and interests of all stakeholders in order to achieve a positive result for each entity;

According to a USAID study, more and more young people who choose to study IT are choosing online training and short-term courses. Universities need to rethink their model in the short cycle bachelor's degree in order to remain attractive to students.

Recommended:

1. Revise the methodology of educational services and apply the education standard 2.0 and 3.0 for all disciplines of the profile part of the curriculum.

2. To revise the teaching model for the short cycle bachelor's degree.

3. As a pilot application of the Education 3.0 standard, develop a course "Informatics" using online approaches for all faculties of KSTU named after I. Razzakov. Based on the results of piloting, other disciplines of the Basic part of the curriculum will be translated.

Recommendations for the development of new SES

In the process of working with KSTU, it was able to participate officially in two meetings of the Educational-methodical association Section No. 10 - Informatics and computer technology, and information technology by profile:

710100 - Informatics and computer engineering

710200 - Information systems and technologies

Date: April 2, 2020

Time: 14:00

Video communication software - ZOOM https://us04web.zoom.us

Questions:

1. The new composition of the Educational-methodical association section No. 10.

2. Discussion of the project of the State Educational Institution of Higher Professional Education of the Kyrgyz Republic and the approximate Working curriculum in the direction 710100 - Informatics and computer technology. Head department ICE KSTU them. I. Razzakov N.A. Israilova

3. Discussion of the draft SES HPE KR and an approximate Working curriculum in the direction 710200 - Information systems and technologies.

4. Recommendations of the UNDP expert Djunushalieva G. D.

Regarding the Requirements for the conditions for the implementation of the main education program for bachelor's degree

An academic course presupposes that the teacher has not only experience, but also sufficient theoretical foundations in the taught discipline, in connection with which the equalization of international professional certifications allows a high degree of confidence to be in the quality of teaching. It should be noted that the experience of working with certain programs is not always clearly reflected in labour records, if a software engineer is indicated, then the department will not have the opportunity to prove that it has experience in a specific programming language Java, C ++, and certification can clearly state the level of training, language and direction.

If clear recommendations are made on international professional certifications, then you can leave 40% and indicate that these certifications are equivalent to a scientific degree for the purpose of teaching and remuneration.

Regarding the Recommendations in the field of advanced training

Professional development and professional retraining programs for teachers should be based on modern, trendy training programs. Currently, there are a number of online platforms such as Coursera, Udemy, EdX, etc., where there are already materials, training techniques in the IT field. It is necessary to achieve active use of the appropriate programs depending on the profile.

In order for our graduates to have access to the international labour market, the following points should be taken into account:

a) The role of a foreign (English) language is significant. Therefore, it is recommended in the curriculum to increase credits for teaching English and provide the opportunity to acquire international language certificates such as TOEFL, TOEIC, etc.
b) In addition to the state diploma, it is recommended to provide the opportunity to acquire certificates from international companies (for example, Oracle Academy, CISCO, Microsoft) recognized in the world arena. Moreover, whenever possible, individual certified courses should be included in the curriculum and allowed to transfer credits through elective courses in our universities.

Regarding the Recommendations for the development of cooperation

It is necessary to take into account the fast pace of development of the IT sphere and use international experience. Within the framework of this project, on an experimental basis, KSTU named after I. Razzakov, Osh Technical University can work in the form of a consortium with technical, and IT universities of the Russian Federation in order to exchange experience, familiarize themselves with educational standards and programs.

In order to attract additional funding and increase the potential of universities, it is necessary to develop cooperation with the donor community. In particular, with projects of international organizations aimed at improving the educational process, taking into account new technologies. In addition, in order to identify the real need in the labour market, develop cooperation with

business, which in the future can be transformed in the formation of an order for trained specialists from the business side.

Certification centres in Kyrgyzstan and Kazakhstan could provide more prospects for the implementation of new modern programs offering not only a state diploma, but also international certificates.

Meeting of the Educational-methodical association section No. 11 - information technologies by profiles:

Software engineering

Cybersecurity analyst

Date: April 14, 2020

Time: 15:00

Video Communication Software - https: \\ vks.megaohm.kg/#login_by_id

Questions:

1. Discussion of the project SES HPE KR and an approximate Working curiculla in the direction of Software Engineering. Saliev, head department ICE KSTU them. I. Razzakov.

2. Discussion of the draft SES HPE KR and an approximate Working curriculum in the direction of Cybersecurity Analyst

3. Recommendations of the UNDP expert

In order to improve staffing, the departments were invited to consider the possibility of attracting experienced teachers from abroad through the introduction of new educational technologies and forms of training: online courses, e-learning, blended learning.

The following recommendations were proposed for the new PMP

	Name of subjects	**Credits**	**Comments**
1	HUMANITARIAN, SOCIAL AND ECONOMIC CYCLE		
	Basic (mandatory) part	**18**	
	Kyrgyz languages literature *	4	
	Russian language	4	To give the opportunity to pass the final exam and those who successfully pass the opportunity to use these credits for elective courses.

	Foreign language	10	Carry out a certification upon completion of the course to confirm the level of knowledge of a foreign language
	Variable part, incl. elective courses	**12**	
	Total:	**30**	
2	MATHEMATICAL AND NATURAL SCIENCE CYCLE		
	Basic (mandatory) part	**30**	
	Math 1.2	10	
	Physics 1.2	10	
	Informatics 1.2	10	The term is outdated can be replaced with digital skills
	Variable part, incl. elective courses	**10**	Strengthen through courses for obtaining international certificates ICDL, Microsoft in direction and profile
	Total:	**40**	
3	PROFESSIONAL CYCLE		
	Basic (mandatory) part	**45**	
	Engineering 1.2 (Electrical, Electronics, Circuitry)	15	Combine subjects and reduce the number of credits
	Computer architecture and organization (KP)	5	
	Database	5	Move a database block into a math loop
	Programming 1	5	Master the programming language Python, JavaScript
	OS	5	
	Computer networks (KP)	5	
	Protection of information	5	Implement a course on international certification for IT-security
	Variable part, incl. elective courses	**85**	
	Total:	**130**	
	PE and sport		
	Practice	**25**	
	Final state certification	**15**	
	In total for the entire period of study:	**240**	

Partnership of universities

To form a long-term partnership development strategy, the expert took the Russian-Kyrgyz consortium of technical universities as a basis for the study.

The Russian-Kyrgyz Consortium of Technical Universities (RKCTU) was established in 2013 based on decisions of the Intergovernmental Kyrgyz-Russian Commission on Trade, Economic, Scientific, Technical and Humanitarian Cooperation (Minutes of the 13th meeting dated April 12, 2011 and the Minutes of the 14th meeting dated April 27, 2012).

The consortium was created with the support of the Ministries of Education and Science of the two countries and is a voluntary association of Russian and Kyrgyz universities that signed the Agreement on the creation of the Consortium and joined it later, sharing the common goals of supporting and developing joint network educational programs.

Permanent members of the Consortium

Universities of the Russian Federation:

1. Altai State University (Altai State University)
2. Altai State Technical University named after I.I. Polzunova (AltSTU)
3. Astrakhan State University (ASU)
4. Baltic State Technical University "VOENMEKH" D.F.Ustinova (BSTU "VOENMEKH")
5. Far Eastern State Transport University (FVGUPS)
6. Kazan State Power Engineering University (KSPEU)
7. Kostroma State Agricultural Academy (KGAA)
8. Kuban State Technological University
9. Kuzbass State Technical University named after T.F. Gorbachev
10. Magnitogorsk State Technical University. G.I. Nosov (MSTU)
11. Moscow Automobile and Highway State Technical University (MADI)
12. Moscow Polytechnic University (MosPolytech)
13. National Research Mordovian State University. N.P. Ogareva (Moscow State University)
14. National Research Moscow State University of Civil Engineering (MGSU)
15. Moscow Technical University of Communications and Informatics (MTUCI)
16. National Research University "MPEI" (MPEI)

17. National Research Technological University (MIFI)

18. National Research "Tomsk Polytechnic University (TPU)" (TPU)

19. Novosibirsk State Technical University

20. Omsk State Transport University (OmGUPS)

21. Perm National Research Polytechnic University

22. St. Petersburg National Research University of Information Technologies, Mechanics and Optics (ITMO)

23. Saratov State Technical University Yu.A.Gagarina

24. North-Eastern Federal University. M.K. Ammosova

25. Siberian State Automobile and Highway University

26. Siberian State Aerospace University named after academician M.F. Reshetnev (SibGAU)

27. Pacific State University (PNU)

28. Tyumen Industrial University (TIU)

29. Ufa State Aviation Technical University (USATU)

30. Southern Federal University

Universities of the Kyrgyz Republic:

31. Military Institute of the Armed Forces of the Kyrgyz Republic named after Hero of the Soviet Union, Lieutenant General K. Usenbekov

32. Kyrgyz State Technical University. I. Razzakov (KSTU)

33. Kyrgyz State University of Construction, Transport and Architecture. N. Isanova (KGUSTA)

34. Kyrgyz National Agrarian University. K. I. Skryabin (KNAU)

35. Kyrgyz National University. J. Balasagyn (KNU)

36. Kyrgyz-Russian Slavic University named after the first President of the Russian Federation B.N. Yeltsin (KRSU)

37. International University of Innovative Technologies

38. Osh Technological University named after. Academician M. Adyshev (OshTU)

RKCTU Board Co-Chairs and Secretariat

The co-chairs of the Board are the rectors of the National Research University "MEI" and the Kyrgyz State Technical University named after I. Razzakov. At the same time, MEI acts as a

coordinator of the Russian universities of the Consortium, representing their interests in the Ministry of Education and Science of the Russian Federation, and KSTU acts as a coordinator of the Kyrgyz universities of the Consortium, representing their interests in the Ministry of Education and Science of the Kyrgyz Republic.

The Consortium's Board includes the following universities: National Research University "MEI", Kyrgyz State Technical University named after I. Razzakov, National Research Technological University "MIFI", Baltic State Technical University "VOENMEKH" D. F. Ustinova, National Research "Tomsk Polytechnic University (TPU)", St. Petersburg State University of Information Technologies, Mechanics and Optics, Kyrgyz State University of Construction, Transport and Architecture named after N. Isanov, Osh Technological University named after Academician M. Adyshev.

The functions of the secretariat are performed by the National Research University "MEI" - for Russian universities (RKCTU@mail.ru) and the Kyrgyz State Technical University n.a. I. Razzakov - for Kyrgyz universities (mei-kgtu@mail.ru and bgtu_kg@mail.ru).

In 2012, the "Information Security" program was opened by A. Saliev.

Six instructors of the department received a master's degree in the direction of "Information Security" (by agreement between educational institutions of KSTU named after I. Razzakov and NRNU "MIFI" (National Research University "MIFI") on the joint training of masters in the direction of "Information Security".

Universities that are potential partners

KSTU has sent an official invitation to the universities of the consortium to participate in the UNDP project in order to cooperate and improve the qualifications of teachers of KSTU.

Positive responses about cooperation were received from three universities:

- National Research University MEI
- National Research University MIFI
- Moscow Technical University of Communications and Informatics

The expert conducted a series of desk studies and interviews with FIT teachers to find out which universities could become long-term partners in the implementation of new educational programs of KSTU.

Table 16 below shows a consolidated list of programs in promising areas of development of FIT. Based on the analysis, we can indicate that these three universities cannot fully cover the potential areas of interest of FIT, which suggests that it is required to find additional partners with whom KSTU could cooperate. One of the potential partners is Saint Petersburg National Research University of Information Technologies, Mechanics and Optics, which implements online training and has such areas as Intelligent systems, neural technologies and others. According to Kabaeva G. Zh. She is planning a meeting with representatives in March, so you can further consider this university based on the results of the meeting.

Table 16. Consolidated list of programs in promising areas of development of FIT

KSTU	National Research University MEI	National Research University MIFI	Moscow Technical University of Communications and Informatics
Department of Informatics and Computer Engineering: IoT - developer (developer of the Internet of things);			
Department of "Informatics and Computer Engineering": Embedded developer (developer of embedded systems)		System analysis and life cycle management of complex systems	
Department of Informatics and Computer Engineering: Data science and data mining.			
Department of Informatics and Computer Engineering: Digital Linguist.			
Department of Computer Systems Software: 1. "Information Security" 1.1. Cyber Security Analyst.	Computer systems security Organization and technology of information protection Security of automated systems	Computer systems security Information security of financial and economic structures Information and analytical support of law enforcement	Information security (profile: Comprehensive protection of informatization objects);
Department of Computer Systems Software: 2. "Software Engineering" 2.1. Decision support system	Computing machines, complexes, systems and networks Computing and measuring systems	Rugged high-performance computing systems Mathematical software and software for computers and computer networks	Informatics and computer engineering (profile: Software and intelligent systems);

	Computer-aided design systems Software development technology Mathematical software and software for computers and computer networks Math modelling		Fundamental Informatics and Information Technology (profile: Software Engineering)
Department of Applied Mathematics and Informatics: 1. Business analytics and Big Data (Data mining) 1.1. Big Data and Machine Learning. 1.2. Intelligent analysis in biosystems	Applied Informatics in Economics Biotechnical and medical devices and systems		
Department of Applied Mathematics and Informatics: 2. Business Informatics 2.1. Internet marketer 2.2. IT Asset Management	Modelling and optimization of business processes Analysis and modelling of business processes in the economy Information and software for business processes Enterprise information systems architecture		Applied Informatics (profile: Applied Informatics in Economics)
Department of Automatic Control: 1. Intelligent control systems of technical complexes	Automated information processing and control systems	Automated information processing and control	Management in technical systems (profile: Information technology in management, profile:

	Management and informatics in technical systems Systems and technical means of automation and control	systems for special purposes High-tech diagnostic systems Bio nanotechnology Automation of technological processes and production in the nuclear industry	Management in cyber-physical systems)
Department of Automatic Control: 2. Internet technologies and Internet of things control			Automation of technological processes and production (profile: Industrial Internet of Things and robotics).
Others	Computer control technologies in robotics and mechatronics Control of mechatronic and robotic complexes	Supercomputer technologies in engineering and physical modelling	Info communication technologies and communication systems (profile: "Software-protected info communication", profile: Information and communication technologies in services and communication services);

International online training programs

In my opinion, it is necessary to draw up a list of teachers for advanced training, then, in accordance with the plan, distribute teachers to the following educational platforms. Based on the results of training, it is possible to revise the teaching staff for the next academic year in order to strengthen their composition for new programs.

From March 13th, all courses from Coursera https://www.coursera.org/ will be free until June 20, 2020. Almost all courses are in English and most of the academic courses are from universities that are easy to transfer to the student. I propose to consider the possibility of studying the following areas

- Computer science
- Software development
- Development of mobile and web applications
- Algorithms
- Computer security and networks
- Design and product
- Data analysis
- Machine learning
- Probability theory and statistics
- Cloud computing
- Safety
- Data management
- networking
- Support and operations

Please pay special attention to the degrees that can be obtained on this platform.

Big Data MasterTrack ™ Certificate (https://www.coursera.org/mastertrack/big-data-asu) the cost of such programs is from $ 5,000.

On another Udemy platform https://www.udemy.com/ you can find courses in Russian and English, but they are not academic, but more focused on training in order to enter the labour market. Pay attention to the following areas of study

- Web development
- Data processing and analysis
- Mobile applications
- Programming languages
- Game development
- Database
- Software testing
- Software development engineering
- Python
- Enterprise Architect
- Network and security
- Microsoft
- Apple
- Google
- SAP
- Oracle
- Game design
- Design thinking
- 3D and animation

This platform has preparation for IT certifications as listed below

- AWS Certification
- AWS Certified Solutions Architect - Associate
- Cisco CCNA
- CompTIA A +
- AWS Certified Developer - Associate
- AWS Certified Cloud Practitioner
- CompTIA Security +
- CompTIA Network +
- Microsoft AZ-900

Another platform https://www.edx.org/ offers 2500 academic courses and programs from 140 universities in the world in Russian and English. This is how you can find courses from ITMO on this platform https://www.edx.org/school/itmox . It is considered that this direction will be very promising. The working style of this platform, the following courses are free, and certification and the final exam are on a paid basis from $ 50 and more. This platform has all directions and all the subjects of the curriculum can be found here, so that is why they are not attached.

Recommendations:

1. The list of potential and promising directions of FIT so that FIT can concentrate on choosing 2-3 most effective directions for this year, and implement the rest over the next three years.

2. Read this report and select two universities that you could take as partners and develop a plan of joint activities for the implementation of new programs and professional development. If you report the results, then you could already start integrating this cooperation at the levels:

a) Curriculum development by subjects
b) Development of SES
c) Development of an advanced training plan

3. The platforms and choose which areas you are interested in for development:

d) FIT will draw up a list of teachers for advanced training
e) Instructors will choose their direction for professional development
f) Instructors will register for courses and will study until June 20, 2020
g) From July to August, internships will be held in Russian universities for those teachers who have successfully received certification of online courses and programs.

Conducting trainings and developing materials for professional development of teachers

As part of the implementation of event 1.6 for the advanced training of teachers and managers of KSTU and OshTU, seminars and digital content on pedagogical innovations were developed. KSTU teachers were trained to create a blended-learning course. This training will help increase the digital competence of teachers who have limited opportunities for the integrated use of ICT for teaching and creating courses on the Moodle platform.

1. Osmonova Rimma Sarymsakovna
2. Tursunkulova Zakhira
3. Duishenbek kyzy Nargiza
4. Korchubekova Totukan Adylbekovna
5. Kasymova Cholpon Kazybekovna
6. Turdalieva Nargiza Abdymomunovna
7. Salieva Ziyadat Talipbaevna
8. Kulenbekova Ainura Sovetovna
9. Saalieva Altynai Nakenovna

100% female participation

June 9, 2020

Seminar for pilot universities of the Kyrgyz Republic - KSTU named after I. Razzakov and OshTU

Workshop program

Time	Topic	Speaker
14.00-14.15	Greetings	UNDP Project Coordinator Kanagat Alyshbaev
14.15-14.45	Concept "Universities 4.0" standards for the formation and dissemination of digital skills	National consultant UNDP
14.45-15.15	Development of the global labour market and training for current demand	Almazbek Beishenaliev

15.15-15.45	Principles of quality learning when applying innovative educational technologies	National consultant UNDP
15.45-16.15	Legal Framework for Digital Skills Development in the Kyrgyz Republic	Zarlyk Zhumabek uulu
16.15-16.30	Trends in digital and IT professions	International consultant UNDP
16.30-16.45	Final word	Gulnara Djunushalieva

Within the framework of the seminar, the most pressing issues of improving the quality of state educational standards using innovative technologies and modern educational process management systems were presented. In particular, the principles of quality learning and characteristics of online and blended learning are presented. In addition, a brief overview of the distribution of hours when using different forms of training is provided for the workshop participants.

Within the framework of the seminar, proposals were also presented for further improving the process of training IT specialists, attracting qualified personnel for teaching, developing online education, using distance educational programs, and improving the educational process.

Questions:

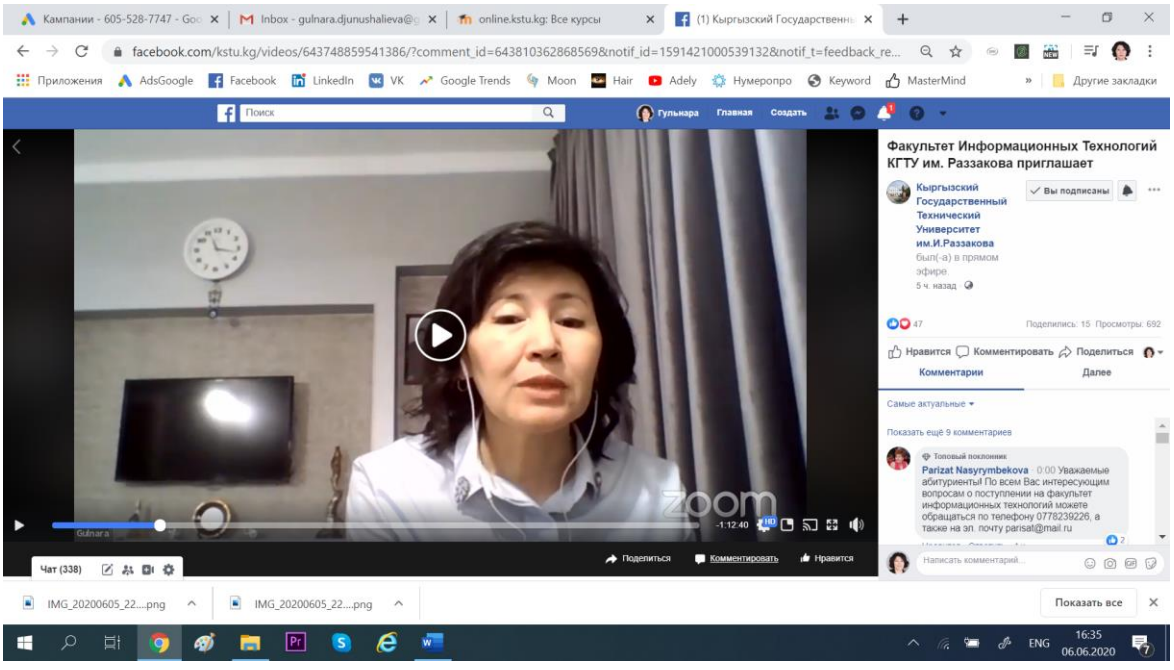
- is there a legal basis for online learning?

Answer: The next expert in his report will cover this issue.

In the course of my work, I hired volunteer Alan Shaibekov to analyse and predict supply and demand for digital professions. Under my supervision, he performed assignments and digitized the results of interviewing employers. The results of the joint analysis were presented in the report “Trends in digital and IT professions”.

June 6, 2020, at the request of the FIT KSTU, I spoke as a speaker at an online conference on Facebook for students and applicants of KSTU named after I. I. Razzakov.

Zoom - 21 and Facebook - 147 (72% women).



https://www.facebook.com/kstu.kg/videos/643748859541386/?__tn__=%2Cd%2CP-R&eid=ARCkyIS1NLj24uo2x-pZ5JoIZCvT0CM9SoOW5SE6jGpNOLJPswSORPsP8JAuEgHlt2yghEMckU9skmrG

May 19, 2020

National online seminar on modern educational technologies EduTech KG 2020

Number of Zoom -36 and Facebook members - 115 members (81% women)

Below is the conference program

Session 2 "Innovative teaching methods and quality assessment" - Education 4.0 and its implementation in the educational process; - Teaching technical disciplines; - The use of cloud technologies in the educational process; - Methods of assessment by means of ICT.	May 19, 2020	14.00 - 17.00 Session schedule: - report up to 15 minutes - questions and answers up to 3 minutes	Gulzada Duishebaeva, member of the national team of experts, Ministry of Education and Science of the Kyrgyz Republic Sabyrkul Kalygulova, member of the national team of experts, Osh State University	Speakers: Dr. Ramon Garrote, Boras University (Sweden) "European Leaders' Views on Interactive Instruments in LMS Systems"; Gulnara Djunushalieva, international consultant UNDP (Kyrgyz Republic) "New trends in education"; Zhyldyz Nisharapova, Director for Academic Affairs of EC AUCA "Ensuring the quality of online education at the AUCA EC during quarantine"

Video recording of the conference

https://www.youtube.com/watch?v=fsYRURMrtc4&feature=youtu.be

https://www.facebook.com/erasmuspluskg/videos/273303993718818/

0:00 Intro

00:28 Lecturer's introduction

00:50 Report.

01:53 Universities and online education what happened?

03:13 The role of the methodologist at the university

06:47 Education without borders

08:50 Transnational education

10:18 Quality and standards

12:38 Presentation of the new online course Informatics

16:30 Answers to questions from conference participants

Questions asked

Facebook members: is it likely that most students would prefer to study online?

What resource do you consider the most optimal for distance learning in the Kyrgyz Republic?

Elmira Sarymsakovna: How long did it take you to develop an online course?

Is the transfer of teaching materials considered as distance education, as many universities do?

Dr. Roman Garrett: What software did you use to create this course? How high is the level of computer literacy among students and teachers? What is your experience with the special needs of students to integrate into online learning?

The thesis of the report will be published and distributed.

NEW TRENDS IN EDUCATION

G.J.Djunushalieva

International consultant UNDP

Annotation

This report examines the transition from classical to online education. This process involves a completely different approach. If in classical education we start from buildings, equipped classrooms, faculty and students, then pedagogical designers begin to play a key role in the new

format of education, and then the process of creating online learning goes from the goals of employers and students to methodologists and then platforms and faculty. At the same time, the goals of various stakeholders often do not coincide and may even contradict, but the task of the methodologists is to create a program with the help of which the student will receive the necessary knowledge / skills and create a portfolio during training, and employers the required employee qualifications. At the same time, the role of the methodologist as a designer of the entire cycle of the educational process is emphasized.

Currently, education, like business, is undergoing a process of globalization, which leads to the fact that now the universities of Kyrgyzstan are forced to compete not with Kyrgyz universities and other educational service providers, but with online universities and educational portals around the world. Edx, Coursera, Udemy today offer not just individual courses, but certified and graduated educational programs from leading universities in the world.

One of the trends is transnational education (TNE) - the British Council's definition of mobile institutions / higher education programs. The UK is ranked # 2 in providing TNE programs worldwide. TNE brings it 11% of all international student tuition income (£ 496 million) in 2015. UUKi report (06.2019) - TNE grew by 81% in the academic year 2018-2019. In 2017, the UK TNE sector had 701,010 students. The number of teaching staff for all other higher education programs in the UK is 438,000. This sector has shown an increase of 5.3% annually since 2012.

The success of new types of education in the active use of the latest technologies, which lead to a guaranteed high quality of education. At the same time, not only mandatory standards are observed in the form of compliance with state standards and accreditations, but also voluntary quality standards. It is on them that many programs related to short-cycle higher education are built.

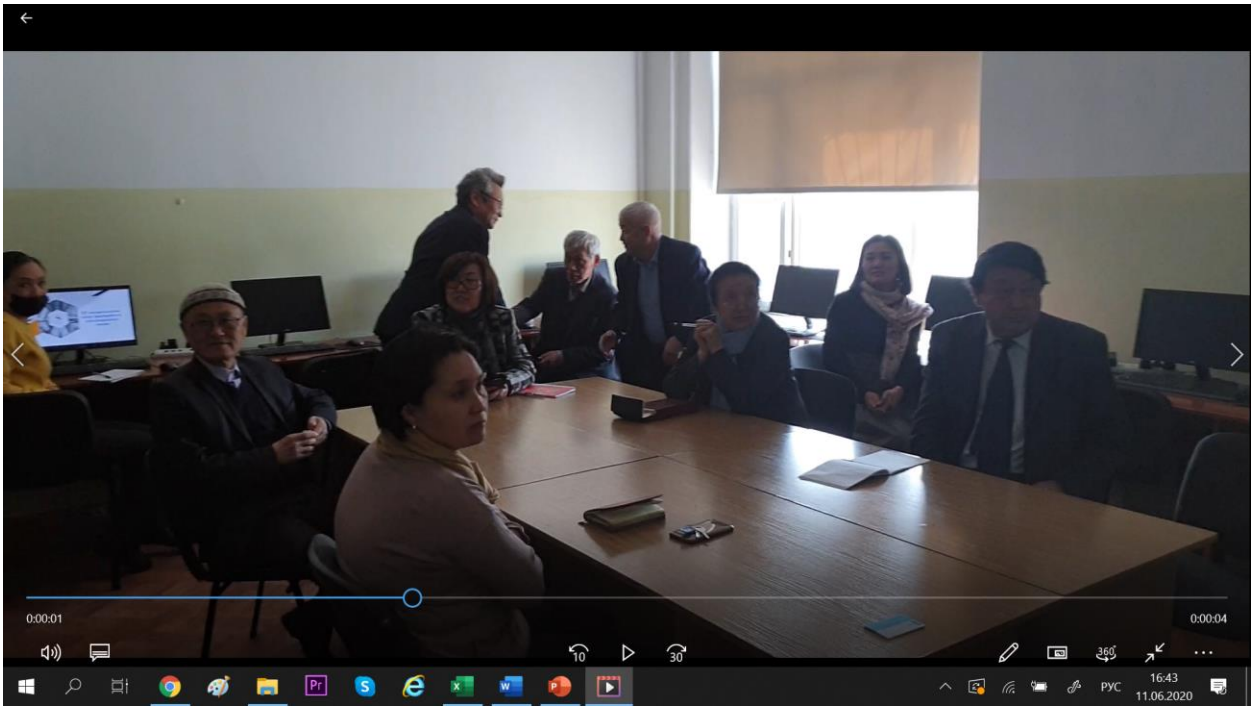
In the field of online education, it is worth paying attention to the standards released in 2019 in the USA, such as the iNACOL Blended Learning Teacher Competency Framework, The National Standards for Quality Online Courses, The National Standards for Quality Online Programs, The National Standards for Quality Online Teaching ... They will be an excellent starting point for developing a modern concept of online education for the university.

Bibliography

TNE 4.0: Technology and TNE. https://www.universitiesuk.ac.uk/events/Pages/Technology-and-TNE.aspx

February 25, 2020

Strategic session with heads of FIT departments and leading teachers of KSTU named after I. Razzakov.



List of faculty members of FIT KSTU named after I. Razzakova at a seminar on new IT areas

Speaker: UNDP expert G. Djunushalieva

02/25/2020, r. 2/515

No.	Name	Position
1.	Kabaeva G.J.	Dean
2.	P.K. Nasyrymbekova	Deputy Dean
3.	Dushenova W.J.	Deputy Dean
4.	Saliev A.B.	Head of Department
5.	Batyrkanov Zh.I.	Head of Department
6.	Toktakunov T.T.	Head of Department
7.	Israilova N.A.	Head of Department

8.	Musina I.R.	Prof. Ph.D.
9.	Stamkulova G.K.	Associate Professor
10.	Kudakeeva G.M.	Senior lecturer
11.	Sydykova K.I.	Lecturer
12.	Tagaeva S.B.	Associate Professor
13.	Mikheeva N.I.	Associate Professor
14.	Kadyrkulova K.	Associate Professor
15.	Tentieva S.M.	Prof. Ph.D.
16.	Sharsheeva K.T.	Senior teacher
17.	Momunalieva N.T.	Senior teacher
18.	Makeeva Z.Dzh.	Associate Professor
19.	Ashirbaev B.Y.	Associate Professor

79% of participants are women.

Session agenda:

14-00 Presentation of the report

14-30 Questions and answers

14-50 Discussion of strategic plans for departments and areas of training.

15-00 Division into groups and schedule of sessions for the next week

The result of this session was the development of new directions of the FIT KSTU for the long term.

Development strategy of new directions of FIT KSTU named after Razzakov

The Department of Informatics and Computer Engineering can provide the following directions in the future:

1) IoT - developer (developer of the Internet of Things);

2) Embedded developer (developer of embedded systems);

3) Data science and data mining.

4) Digital linguist.

The Department of Software for Computer Systems can provide the following directions in the future:

1. In the direction of "Information Security"

1.1. Profile: Cyber Security Analyst.

2. In the direction of "Software Engineering"

2.1. Profile: Decision support system

The Department of Applied Mathematics and Informatics can provide the following directions in the future:

1. Business analytics and Big Data (Data mining)

1.1. Big Data and Machine Learning.

1.2. Intelligent analysis in biosystems

2. Business Informatics

2.1. Internet marketer

2.2. IT Asset Management

The Department of Automatic Control can provide the following directions in the future:

1. Intelligent control systems for technical complexes

2. Internet technologies and management

2.1. Internet of things

Draft "Strategies for the Development of Digital Skills"

The aim of this project is to develop a strategy that could serve as a basis for achieving the indicator of Sustainable Development Goal (SDG) 4.4.2: "Percentage of youth / adults who have achieved at least a minimum level of digital literacy skills." One of the goals of the Information for All Program of the United Nations Educational, Scientific and Cultural Organization (UNESCO) is education for all throughout life, as well as creating conditions for ensuring free access to information resources, education and training in computer literacy and information culture. There are 195 countries in the UNESCO structure, including the Kyrgyz Republic.

Stakeholders

Developing a digital skills development strategy in the Kyrgyz Republic is a political challenge. “First, the range of policy areas to be considered collectively is very broad and includes infrastructure, education and skills development, labour market, competition, science, technology and innovation, fiscal issues, and trade and industrial policies. It requires effective inter-sectoral collaboration, both within government and between stakeholders. The government should seek opportunities presented by the digital economy in support of relevant sustainable development objectives. Coordination of inter-sectoral policies is a challenge for any country, but especially for those countries whose resources are limited. "

The working group developing the digital skills strategy must be empowered to bring together all stakeholders. Since digital skills are essential for effective participation in all aspects of life and work, it is important to involve all relevant ministries and departments in shaping the digital skills strategy.

- MoE (digital economy);
- SCITC (ICT / communication);
- MoL (world of work / labour force);
- MoES (education);
- MoH (health care);
- GAMSUMO (Rural Development).

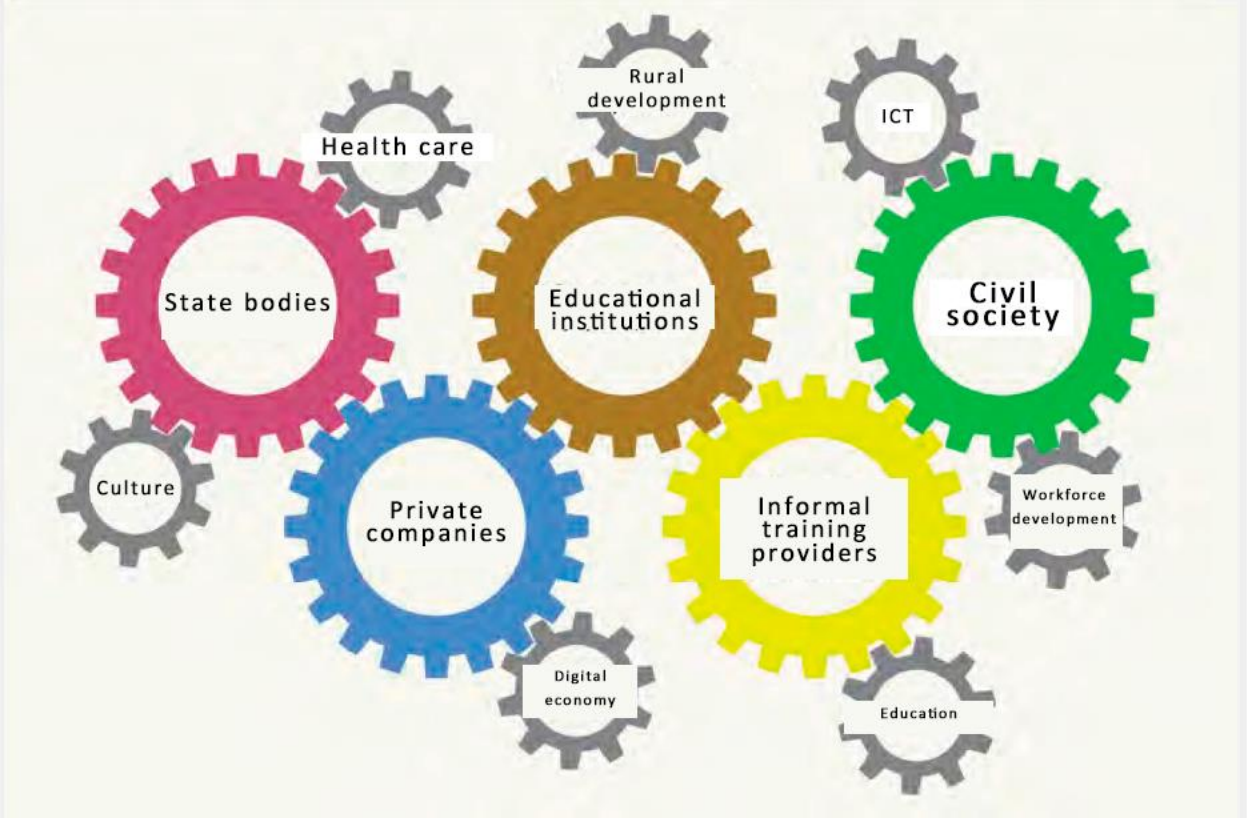


Figure 17. Stakeholder Engagement

Educational institutions

Educational institutions play a very important role as they shape the teaching methodology for future IT professionals. It is desirable to involve representatives from all levels of education, including schools, technical and vocational schools, colleges and universities.

Private sector

It is imperative to involve the private sector, not only to ensure that digital skills plans are aligned with the workforce needs and technology plans of companies, but also to include them in the planning process. For example, the private sector can engage in skills training, including internal online platforms for companies or reward systems for employees who continually develop their digital skills - and this is important for repurposing the existing workforce, displaced by advances in automation and replacement work technologies.

International business often acts as foreign technology companies willing to invest in the development of the country's digital skills base. In addition, mobile operators are increasingly

involved in improving digital and mobile literacy as they see commercial opportunities in the growing number of people with digital skills.

Civil society

Civil society participation is equally important. Civic organizations representing ethnic minorities, people with disabilities, youth, women and other target or marginalized groups can ensure that digital skills planning is tailored to the needs of these populations.

NGOs and community centres offering educational programs are also important actors given the role they play in providing lifelong learning opportunities.

Non-formal digital skills training service providers

Commercial and public training courses for beginners, volunteers teaching digital skills through national, regional or international digital skills campaigns, and Hi-Tech Parks, hubs and IT start-ups can all provide advice and guidance on developing a nationwide digital education program and can play a key role in its implementation.

Digital skills

The transition of Kyrgyzstan to the digital economy will require, first of all, the formation of a digital society, since hardware without proper management will not work. Every citizen will be required to possess a certain set of digital skills for work and life.

In the world of work, digital skills not only qualify for employment in the traditional sector, but also open the door to engaging in emerging sectors of the economy and even starting your own business. People with more advanced digital skills can take advantage of a wider range of opportunities associated with the continuous development of digital technologies, platforms and devices.

Figure 18. Digital Skills Level

Digital skills are particularly important in the face of the changing nature of the work environment including a dramatic increase in the use of freelance workers and people in the gig economy, as well as broader structural changes that will significantly affect future jobs.

Citizens with the digital skills required by this digital society will have access to information (for home and work), the ability to benefit from e-health, e-government, digital finance, Argo technologies, smart transportation, and otherwise benefit from participation in digital economy. Figure 18 above provides an understanding of the four levels of digital skills required for a digital society. The digital skills required are changing with technology, and we expect the changes to be significant.

The main digital skill levels are zero, basic, intermediate, and advanced. For these levels, we will be forced to constantly revise and update the set of digital skills in curricula, and this is due to

the emergence of new technologies and innovations: artificial intelligence, big data, block chain, cloud computing, Internet of Things (IoT), machine learning and mobile applications.

Digital Awareness – Zero Level

A discrete set of basic digital skills for all citizens of a country may include basic hardware and software interactions, email, Internet and search skills. These skills allow you to function at a minimum level.

Digital Literacy – Basic Level

Digital literacy includes the foundational skills needed to complete basic tasks. Basic skills include working with hardware (for example, using the keyboard and touch screen functions), software (for example, working with word processing applications, managing files on a laptop, security settings on a mobile phone), and basic online operations (for example, ability to use email, search, or fill out online forms). Basic skills enrich our lives by allowing us to interact with each other and gain access to government, commercial and financial services.

Digital Competence - Intermediate Level

Digital competence enables the use of digital technology in an even more meaningful and beneficial way and includes the ability to critically assess technology or create content. These are effectively the skills of a ready-to-work professional, as they cover those skills that are required to perform work functions such as computer layout, digital graphic design and digital marketing. For the most part, these skills are generic, that is, mastering them prepares an individual for the broader digital tasks required to participate as an engaged citizen and productive worker. However, such skills do not have rigid characteristics. On the contrary, one of their characteristics is that they expand according to technological change. For example, data processing skills are becoming more pronounced as the data revolution gains momentum, generating demand for the skills needed to produce, analyse, interpret and visualize large amounts of data.

Digital Expert – Advanced Level

The digital expert level includes those skills that are required for ICT professionals. Globally, tens of millions of jobs are projected to emerge in the coming years, requiring advanced digital skills. Advanced digital skills are usually acquired through formal forms of higher education. The skills learned in higher education institutions include artificial intelligence (AI), big data, coding,

cybersecurity, the Internet of Things (IoT), and mobile app development; however, given the rapidly changing roles, a shortage of professionals with such advanced digital skills and other ICT professionals is projected in Kyrgyzstan. Many employers say they cannot find employees with the necessary skills. Positions that require advanced digital skills are also generally paid much better than positions that require only basic digital skills or are irrelevant.

Many experts distinguish digital entrepreneurship and finance as separate categories in digital skills, which combine the two sectors. For example, traditional entrepreneurship with new digital technologies or banking sector with IT technologies.

Digital skills framework and international standards

As stated, digital skills are evolving and they are constantly being updated according to changes in technology. The structure of digital skills plays an important role in assessing their composition as well as changes, which allows policymakers and digital skills service providers to ensure that their programs and curricula are aligned with the current situation.

In 1995, the Council of European Informatics Professional Societies (CEPIS) created a working group supported by the European Commission's Research Program (ESPRIT) to explore ways to improve digital literacy across Europe. The new certification program was launched as a European Computer Driving License in Sweden in August 1996. As ECDL rose to prominence in Europe, the number of candidates exceeded 1 million and continued to grow; this success has attracted the attention of countries outside Europe, which have begun to show great interest in the concept. Subsequently, ECDL was introduced outside of Europe, where the certification became ICDL (International Computer Law). In 2001, the European / International Computer Driving License (ECDL - European / International Computer Driving License) certification program was recommended by the European Commission as the main standard for computer literacy.

By 2012, the European Union has reached the planned targets for the elimination of computer illiteracy in all European countries, and the European Commission adopted a resolution to develop a new standard for digital competence of citizens.

The Digital Citizens Competence Framework (DigComp) is a digital citizen competency enhancement tool designed to help policymakers formulate policies that support digital competency building and plan educational initiatives to improve digital competence in specific

target groups. DigComp also formulates a single language for identifying and describing key areas of digital competence, thereby offering a reference standard across Europe. "DigComp 2.0 “Communication and Collaboration” was adopted in 2016. An analysis of this skill coverage standard is provided in Appendix 1 of this report.

Below is a list of the most popular digital literacy standards:

- DigComp 2.0 - European countries
- ICDL - 150 countries (Europe, Asia, America, Africa).
- Microsoft (Microsoft Digital Literacy Curriculum) - 11 countries (Africa, Asia)
- Certiport Internet and Computing Core Certification (IC^3) - 13 countries (Africa, Asia).

Digital Skills Strategy Roadmap 2020-2024

1. Create a working group of representatives of all stakeholders (representatives of the Government of the Kyrgyz Republic, ministries and departments, project consultants) on digital skills:

- A working group is needed to engage a variety of stakeholders who can contribute to the development and / or implementation of the strategy including identifying current and future digital skills needs and related goals across sectors.
- Develop a vision and strategy goals in conjunction with government agencies. Conduct a broad discussion and information campaign.
- Analyse the strengths and weaknesses of each stakeholder and, based on the findings, identify the roles they can play in the development and implementation of the strategy.
- The proposed analysis and roles should be agreed upon to establish common management principles, working methods and working order for the working group.

2. Highlight the main levels of digital skills to be developed within the strategy.

- Determine the level of digital competence by industries contributing to the GDP of the Kyrgyz Republic;
- Analyse the curriculum of KSTU, develop new educational standards and identify how the relationship between digital skills and skills of the 21st century are taken into account.
- Consider building the foundations for more advanced digital skills such as digital entrepreneurship in education sphere.

3. Set goals for digital skills development at levels:

- Continuous and additional education and retraining of specialists;
- Primary vocational education;
- Secondary vocational education;
- Higher professional education.
- Programs for teaching skills for life and for work in socially vulnerable groups of the population (PWD, girls);

4. Map programs, projects and donor initiatives to underpin the goals of the digital skills strategy

- Existing policies, plans and programs that support digital skills development;
- International projects and programs;
- Business companies and international organizations.

5. Identify current and future trends related to demographic trends, technological change, business trends and the transition to a green economy.

6. Develop new policies

- Formulate and adopt new policies and programs,
- Conduct advocacy on the use of policies;
- Develop a support system for new policies.

7. Study international experience and strategies successfully implemented in other countries. Benchmark goals against existing entities or countries sharing similar goals.

8. Determine the existing priorities in the working group,

- Develop strategy objectives;
- Conduct an analysis of the difficulties in achieving the goals.
- Identify promising digital skills development solutions.

9. Develop a budget for the implementation and identification of funding sources

10. Designate HEIs, lyceums and technical schools that will provide training in various types of digital skills, including employer-led training, technical and vocational education, coding bootcamp courses, other commercial and community training providers, makerspaces, informal providers services that support digital skills campaigns, campaigns, etc.

11. Determine the needs of providers (funding, training, curriculum development) and agree on the allocation of funds, including the creation of communities to share experiences among training providers.

12. Conduct an analysis of existing educational programs, curricula and educational service providers who can be involved in the achievement of strategic goals and the development of new curricula.

13. Set objectives and goals for each of the components of the strategy.

14. The resulting strategy should be presented for discussion and finalized based on the comments from the working group.

15. Start implementing the strategy.

16. Conduct advocacy in support of the strategy and associated learning opportunities.

17. Regularly monitor and analyse the implementation of tasks and allocated resources to achieve the goals of the strategy.

18. Creation of a platform for collecting information and exchange of operational information on the progress of the strategy implementation.

19. Hold regular regional, national or local meetings to encourage communities to share experiences among incumbent training providers to improve skills delivery and award rewards that stimulate the achievement of the digital skills strategy goals.

20. Publish best practices and resources identified during the sessions for exchange with digital skills stakeholders.

21. Join global digital skills campaigns to encourage stakeholders to deliver digital skills training in line with the different components of an agreed digital skills strategy.

22. Collect data for analysis and monitoring.

23. Exercise control by collecting reports on the final and intended results and the analysis of relevant indicators.

24. Periodically review and update the strategy to ensure that it reflects forecasts for the future of the labour market and technological development.

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Appendix 1. Mapping of selected literacy frameworks

Table 3. Mapping of selected digital literacy frameworks onto the extended DigComp framework

Digital literacy frameworks	0	1	1.1	1.2	1.3	2	2.1	2.2	2.3	2.4	2.5	2.6	3	3.1	3.2	3.3	3.4	4	4.1	4.2	4.3	4.4	5	5.1	5.2	5.3	5.4	6	Total
Kenya Basic Education Curriculum Framework	5			2		4			3					5		2	3			2			2			2	2	6	**38**
Philippines ALS-K to 12 LS 6	7		19	1	6		3	4		1	4	2		19	4	3		4	1	6	5					3	6		**98**
India Pradhan Mantri Gramin Digital Saksharta Abhiyan (PMGDISHA)	1		4		2	1	1	1	1					1															**12**
Costa Rica Student Performance Standards in Digital Technology-enhanced Learning	15		4	4	4		4	6	1	10	5			11		1	10	8	3	2	1			1	1	3	13		**107**
Chile SIMCE TIC Matrix of ICT Skills for Learning			2	2	2		1								3	1				1	1						1		**14**
British Columbia Digital Literacy Framework	8	1	13	4	1	5	3	2	4	2	7	5		6	3	5	4	1	3	4	8	1	4	5	2	3	2		**106**
IC3 Global Standard 5	16		16	1	14		5	3			2	1		14	2	1	1	1	5	4	3			1		1	3		**94**
ICDL Competences	21		22	5	19	1	5	2		4	3	1		41	10	2	3	2	8	6	3	1				2	12	4	**177**
Microsoft Digital Literacy Standard Curriculum Version 4	15		13	1	5		1				1			10	3	1			5	2	1						7	2	**67**
Total no. of instances mapped	**88**	**1**	**93**	**20**	**53**	**11**	**23**	**18**	**9**	**17**	**22**	**9**	**0**	107	**25**	**16**	**21**	**16**	**25**	**27**	**22**	**2**	**6**	**7**	**3**	**14**	**46**	**12**	

Note: Underscored competence areas (0 and 6) are proposed additions to the existing DigComp 2.0 competence areas and competences.

Appendix 2. Data on salaries by vacancies of the DevKG Telegram channel for the period February-April 2020.

Category	Position	Salary	Type	Duty station
Backend	Back end Developer	440-760$	Full-time	Bishkek
	Frontend- Developer (vue.js)	1000-1500$	Full-time	Bishkek
	Front-end Developer	From 600$	Distant	
Frontend	Middle Front-End Developer (Angular 2+)	From 1800$	Distant	
	Junior Front-end Developer	250$	Full-time	Bishkek
	Middle Front-end Developer	1000$	Full-time	Bishkek
	Middle Front-End Developer (React)	1000-3000$	Distant	
	Senior Front-end Engineer	From 2000$	Full-time	Bishkek
	Frontend Developer	From 400$	Full-time	Bishkek
	Frontend- Developer (vue.js)	1000-1500$	Full-time	Bishkek
Fullstack	full stack Developer	From 1200$	Full-time	Abroad
	Fullstack Developer	From 400$	Full-time	Bishkek
	Senior Full Stack C# Developer	2500-3500$	Full-time	Bishkek
	Full Stack Developer (React JS + Laravel)	100-2000$	Distant	
	Full Stack Developer - Freelance	800$	Part-time	
	Full Stack Developer - Freelance	500$	Part-time	
	Middle+ Fullstack Developer (React+Node.js)	From 1800$	Distant	
Instructor	Java Instructor	510-1015$	Full-time	Bishkek
	Front-end Instructor	510-1015$	Full-time	Bishkek
	Python Instructor	510-1015$	Full-time	Bishkek
	JavaScript Mentor	380-890$	Full-time	Bishkek
	Python Mentor	400-1000$	Full-time	Bishkek
	Fullstack mentor	250-380$	Full-time	Bishkek
	Python Mentor	250-890$	Part-time	Bishkek
	Python Mentor	400-600$	Full-time	Bishkek
	Php Mentor Assistant	300-600$	Full-time	Bishkek
	Php Mentor	400-600$	Full-time	Bishkek
	JavaScript Mentor	400-600$	Full-time	Bishkek

System Administrator	System Administrator	300-700$	Full-time	Bishkek
	System Administrator (2)	From 445$	Full-time	Bishkek
	System Administrator	500-700$	Full-time	Bishkek
Java	Java / Kotlin Developer	From 1500$	Distant	
	Java Developer	1000-2000$	Full-time	Abroad
	Middle Java Engineer	From 500$	Distant	
	Junior Java Developer	From 300$	Distant	
	Javascript Developer	1000-2000$	Full-time	Bishkek
	Javascript Developer	1000-2000$	Distant	
	Java Developer	From 800$	Full-time	Bishkek
	JavaScript (ReactJS) Developer	1000-1700$	Full-time	Bishkek
Android	Android Developer	1100-1500$	Full-time	Abroad
	Middle Android Developer	600-1500$	Full-time	Bishkek
	Android Developer	1600-2200$	Full-time	Bishkek
	Android- Developer	500-1000$	Full-time	Bishkek
	Middle/Senior Android Developer	800-1500$	Full-time	Bishkek
	Android Developer	2000$	Part-time	
	Junior/Middle Mobile Developer ios/android	400-1000$	Distant	
iOS	iOS App Developer	From 630$	Full-time	Bishkek
	iOS Developer (junior/middle)	250-1000$	Full-time	Bishkek
	iOS Developer	From 1000$	Full-time	Bishkek
C#	Specialist C#, C++	350-600$	Full-time	Abroad
	C# Developer	1000-1200$	Full-time	Bishkek
	Junior/Middle C# Developer	250-1000$	Full-time	Bishkek
	Middle/Senior C# Developer	From 700$	Full-time	Bishkek
	Junior C# Developer	200-500$	Full-time	Bishkek
	Middle C# Developer	500-1500$	Full-time	Bishkek
	Senior C# Developer	1500-2500$	Full-time	Bishkek
	Junior/Middle C# Developer	250-1000$	Full-time	Bishkek
	C# Developer	500-1000$	Full-time	Bishkek
PHP	PHP Developer (middle)	400-2500$	Part-time	

	Senior PHP Developer (2)	From 1015$	Full-time	Bishkek
	PHP Developer	760-890$	Full-time	Bishkek
	Senior PHP- Developer	900-1500$	Full-time	Bishkek
	PHP Developer	From 760$	Full-time	Bishkek
	PHP/WordPress Developer	200-1000$	Distant	
	PHP Developer	500-800$	Full-time	Bishkek
	Middle PHP- Developer	500-900$	Full-time	Bishkek
	SQL Developer. DWH/BI Analyst	630-1140$	Full-time	Bishkek
SQL	Reporting Specialist (SQL)	From 315$	Full-time	Bishkek
	Web - Developer	500-2000$	Full-time	Bishkek
	WEB-service Developer (PHP, Angular or React or Vue)	760-1140$	Full-time	Bishkek
	Web designer	190-380$	Full-time	Bishkek
	Layout / website designer	380-760$	Distant	
	Layout / website designer (middle, senior)	380-760$	Full-time	Bishkek
	Software Testing Engineer	300-800$	Full-time	Bishkek
WEB	Junior test-engineer	300-400$	Full-time	Bishkek
	Sales Manager with English skills	190-510$	Part-time	Bishkek
	Quality Manger	250-630$	Full-time	Bishkek
	Content Manager	220$	Full-time	Bishkek
	Project Manager	From 380$	Full-time	Bishkek
	Sales Manager/IT Consultant	300-1000$	Full-time	Bishkek
	Report Developer	From 1000$	Full-time	Bishkek
	Fraud Management Administrator	From 600$	Full-time	Bishkek
	Date Base Administrator	From 760$	Full-time	Bishkek
	React Native Developer	2000-4000$	Distant	
	React Native Developer	1000$	Part-time	
	.Net Developer Middle/Senior	510-1520$	Full-time	Bishkek

Appendix 3. Website traffic for job search

Website traffic devkg.com

Open statistics

Data	Day	Week	Month
Views	370	2 590	11 100
Visitors	100	700	2 760

Website traffic diesel.elcat.kg

Open statistics

Data	Day	Week	Month
Views	335 000	2 350 000	10 370 000
Visitors	29 300	205 000	907 000

Website traffic employment.kg

Open statistics

Data	Day	Week	Month
Views	1840	12 880	55 000
Visitors	460	3 220	13 800

Website traffic headhunter.kg

Open statistics

Data	Day	Week	Month
Views	1 199	6 428	27 486
Visitors	365	1 802	7 168

Website traffic job.kg

Open statistics

Data	Day	Week	Month
Views	14 861	92 302	435 000
Visitors	6 445	42 632	202 000

Website traffic lalafo.kg

Open statistics

Data	Day	Week	Month
Views	168 000	1 180 000	5 030 000
Visitors	28 700	201 000	861 000