

**ICT PROFESSIONAL SKILLS AND ICT CAREER –
REPUBLIC OF MOLDOVA CASE STUDY**

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Actuality: Developing professional skills in ICT is a key factor that determines the development of the ICT sector from Moldova. In 2014 ISDI and StarNet launched the initiative of establishing a network of centers of excellence in ICT outside the capital of the country. The initiative is based on a pre-feasibility study conducted by the ISDI team during December 2014 – February 2015. The aim of the article is to analyse the results of the pre-feasibility study, with a focus on surveys and discussions held with representatives of public authorities, teachers and pupils from 6 visited districts. The article presents some of the results of the visits made by ISDI team and an analysis of international and local situation in the area of ICT professional skills. The methodology comprises several research methods: data analysis (statistical and pre-feasibility study period), statistical review, descriptive method, comparative method, case studies. Results: It was performed an analysis of the international and European experience in e-skills field. Survey results and discussions shows that pupils want new extracurricular activities in their localities in the area of ICT. Teachers and public servants support the idea of creating centers that would allow students to develop their ICT professional skills.

Key words: ICT professional skills, centers of excellence in ICT, computer science, ISDI, Information and communications technology.

Actualitatea: Dezvoltarea competen elor profesionale în domeniul TIC reprezint un factor cheie care determin dezvoltarea sectorului TIC din Moldova. În 2014 IDSI i StarNet au lansat ini iativa privind crearea unei Re ele de Centre de Performan în TIC în afara capitalei. Ini iativa are la baz un studiu de prefezabilitate realizat de echipa IDSI în decembrie 2014- februarie 2015. Scopul articolului este analiza rezultatelor studiului de prefezabilitate, cu accent pe sondajele i discu iile organizate cu reprezentan ii autorit ilor publice locale, profesorii i elevii din 6 raioane vizitate. Articolul reflect câteva dintre rezultatele vizitelor realizate de echipa IDSI în teritoriu precum i analiza situa iei interna ionale i a celei locale în domeniul e-competen elor. Metodologia utilizat cuprinde un mai multe metode de cercetare: analiza datelor (statistice i cele colectate pe parcursul studiului de prefezabilitate), revizuirea statistic , metoda descriptiv , metoda comparativ , studii de caz. Rezultate: A fost realizat o analiz a experien ei interna ionale i europene în domeniul competen elor profesionale. Rezultatele sondajelor i a discu iilor organizate arat c elevii î i doresc activit i extracurriculare în localitatea lor în domeniul TIC. Profesorii i func ionarii publici sus in ideea de creare a unor centre care ar permite elevilor dezvoltarea competen elor profesionale TIC.

Cuvinte cheie: competen e profesionale TIC, centre de performan în TIC, informatica, IDSI, Tehnologia Informa iei i Comunica iilor.

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JEL Classification: I2; I21; I25; J2; L63; L86; L96.

Introduction and methodological issues

In 2014 Information Society Development Institute (ISDI) and StarNet company launched the initiative of establishing Centers of Excellence in Information and Communications Technology (ICT) outside the capital of Moldova. For this purpose, a pre-feasibility study was carried out by ISDI team during December 2014 – February 2015. This article aims to present the results of the study, as well as an analysis of the international and national situation in the field of digital literacy, focusing on survey results carried out in several districts of the country.

The localities to be included in the launched initiative were identified by means of a desktop research of several districts, based on a set of criteria such as: general situation in the district - existence of youth centers; business incubators activities etc.; the results of mathematics and computer science study contests (olympiads) from 2013-2014; level of teacher training etc. Following the desktop research, several surveys were carried out on different categories of respondents in 8 identified districts, 6 of which were visited by ISDI team to assess the level of communities' readiness and the receptivity of key actors to such an initiative. Four types of questionnaires were developed for the survey, one for each category of potential beneficiaries and stakeholders: local public authority (LPA) representatives; school and college principles; teachers; pupils. The questionnaires designed for LPA representatives were focused on district presidents, mayors, officials from the departments of education and other relevant departments. These questionnaires were aimed to understand whether there is political will in each locality, which could ensure the establishment as well as sustainability of IT centers. The questionnaires for school and high school principles were aimed to identify the available resources, as well as the willingness of schools to get involved in the project. Questionnaires for teachers, mostly for those teaching computer science, as well as mathematics or physics, included questions concerning the openness of teachers to participate in this project and their potential role in the activities of the Center. Questionnaires for pupils were aimed to identify the interest of pupils in ICT and their willingness to attend an IT center in their locality. Questionnaires were available in various formats: on paper, distributed by ISDI project team in visited localities; in Word format – sent by e-mail to identified contacts and on-line questionnaires.

Look@IT Network mission is to provide support to pupils and teachers for enhancing the knowledge, acquired during regular curricular studies and to gain more advanced ICT skills, complementary to the curricula, as well as to guide pupils towards ICT jobs and specializations, according to the increasing demands of the labor market and for personal fulfillment.

International experience regarding ICT professional skills

Obtaining adequate quantities of workers with the right e-skills is proving to be a challenge across the world. Many countries are reporting difficulties in creating sufficient numbers of workers with the right skills in the right place at the right time. In *Europe* it is estimated that there will be an ICT skills gap within Europe of up to 1.3 M practitioners by 2020. *USA* states that, unlike the fiscal cliff where they are still peering over the edge, they careened over the "IT Skills Cliff" some years ago as the economy digitalized, mobilized and further "technologized" and their IT skilled labour supply failed to keep up. In *Canada* it is widely acknowledged that it is becoming increasingly difficult to recruit for a variety of

critical ICT occupations – from entry level to seasoned. *Brazil's* ICT sector requires about 78,000 [new] people by 2014. But, according to Brasscom, there are only 33,000 youths studying ICT related courses in the country [6].

The ability of European companies to compete and evolve in the early 21st century depends increasingly more on the innovative and efficient use of new technologies. E-skills strategy is part of the Digital Agenda for Europe and the Employment Package to boost competitiveness, productivity and employability of the workforce. Europe aims to create better framework conditions for innovation, growth and new digital jobs. Despite high levels of unemployment, e-skills shortages continue to grow in all sectors. The lack of coordination between the available skills and labor market needs exists in all EU member states, although in varying degrees. Remarkably, the demand for ICT specialists, which increases by approximately 4% per year, still exceeds the supply. Almost 500,000 vacancies are expected by 2015 and most of them will remain vacant, unless more will be done to attract young people to get degrees in computer science and unemployed will be reoriented towards the same specialities [4].

Digital skills deficit is particularly alarming in terms of new emerging technologies. A survey conducted by IBM among 1,200 IT specialists and decision makers from 13 countries, showed that two thirds of them believe that mobile, analytical, social and cloud technologies are strategically important; however, 25% reported major shortages of skills in each sector and 60% reported moderate to major deficits. European governments significantly increase their efforts to reduce skills shortages by means of policies, initiatives and dedicated partnerships. There are additional positive signals, when member states are becoming more active, such as Greece, Italy and Bulgaria that have established in 2014 National Coalitions for Digital Jobs as part of the “Great Coalition for Digital Jobs” launched by the European Commission in March 2013.

ICT professional skills overview in the Republic of Moldova

Like many other states Republic of Moldova is facing the problem of shortage of highly qualified ICT specialists. No doubt this phenomenon has many causes. The crisis of the political, economic and social system under transformation after the fall of the Soviet totalitarian regime led to the reduction of a large number of jobs. Combined with low salaries, this caused the emigration of specialists from Moldova. Another cause is the poor quality of specialists training in our country. Although the annual number of ICT university graduates is quite high, their quality is low due to outdated teaching methods and curriculum etc. An effective partnership between the educational, academic (research and development) and business sectors is missing and there is a low number of qualified teachers. Out of the 1,500-2,000 graduates every year, only 20-30% can be immediately employed and the companies have to make investments of about half a year in their training [7].

Despite economic difficulties, recently the Republic of Moldova assured a steady increase of funds allocated to education. During 2005-2012, the share of public expenditure on education in GDP increased from 7.9 to 8.4% [9]. According to the analyses of educational strategies [9] [10], the number of young people interested in vocational secondary education and specialized secondary education is decreasing, the focus being on higher education. In the academic year 2012-2013, in 66 secondary vocational education institutions there were 19,580 students, compared to 24,500 in 2007-2008. At the beginning of the academic year 2012-2013, the number of students in 47 colleges (41 public and six private institutions) was of 30,700 people, showing a decrease of 2% compared to the academic year 2007-2008 [10].

The belief that only higher education can make you a professional and get you a well paid job is still popular among youth in Moldova. Young people do not feel ready and motivated to choose their career and have no alternatives for personal and professional development.

On the other hand, employers are warning that graduates are not adequately prepared for the labor market. The lack of qualified personnel for various activities is one of the main barriers to business development, as reported by local and international companies in Moldova. This is confirmed by the position of Moldova in international rankings of competitiveness and ease of doing business. The international ranking of competitiveness for 2014-2015 placed Moldova on the 84th position for quality of higher education and 82nd position for labor market efficiency, among 144 countries included in the report. As shown in numerous studies carried out in this regard, one of the main problems of the vocational education in the country is the mismatch between labor market demand and the educational offer, therefore the education system doesn't provide a sufficient number of graduates for required occupations as well as adequate skills required for these occupations [3]. Likewise, the poor preparation of higher

education graduates is due to poor preparation in high school. This fact is confirmed by the results of the baccalaureate exam (in 2014 – 44% passed the basic exam session [1]).

ICT education is limited by the low rate of computer coverage and their use at a later age. There were about 35,584 computers in the education system in the academic year 2012-2013. A low rate of computer coverage of about 15 pupils per computer, compared with maximum 3 children per computer in the EU, is also complemented by a high degree of computer wear: half of the PCs are outdated. Furthermore, ICT education is carried out through the subject of Computer science, which is compulsory from the VIIth grade. However, in the majority of EU member states ICT education, in one form or another, begins in elementary school.

Interactive ICT methods and devices are not widely used in teaching various subjects. In the academic year 2012-2013, only 6061 computers were used by teachers. In order to deeply integrate ICT in the educational process, 140 schools were equipped with specialized software for core subjects, but they are used in different degrees due to a low motivation and insufficient teachers training. Out of 1,400 teachers who teach Computer science in general education system, 50% have real sciences background and only 36% have specialised background in teaching computer science. Most teachers are not involved in continuous training activities and often don't have access to the adapted Computer science curriculum [9].

Case study: the survey regarding the establishment of the Look@IT network in Moldova

In the period **16 December 2014 - 6 February 2015**, the Look@IT project team from ISDI visited six regional centers: Ungheni, Nisporeni, Drochia, Soroca, Cahul and Comrat (Gagauzia). These regional centers were selected based on the analysis of the results of regional contests in computer science and mathematics; on the promotion rate of the Baccalaureate exams and the level of teacher readiness in schools.

The research methodology is based on 614 completed surveys and six discussion groups. The target group of the research included 487 students, 115 teachers and 12 officials from local governments. Most questionnaires (95%) were completed on-line, the rest were completed on paper, scanned and sent by e-mail. The error is about 4% [11].

The meetings were attended by 8 people in Ungheni (directors, teachers and officials from the Directorate of Education), in Nisporeni – by 14 people, Drochia - 2 (district president and mayor), Soroca – 6 people, Cahul – 27 and Comrat – by 28 people. All 6 visited localities expressed a unequivocal political will on the initiative launched by ISDI and StarNet. The readiness level of the 6 districts is appropriate: there are business incubators, supporting business initiatives at the local level; district and local authorities (councils, mayors) have websites which are used to inform citizens and ensure transparency of decision-making; there are youth centers; local projects; municipalities or districts have medium-term (2020) development strategies etc.

Table 1

Number of pupils in primary and secondary schools in 2013-2014 in the visited/analysed districts

District	Pupils
Drochia	8247
Nisporeni	7717
Orhei	11974
Soroca	8707
Str eni	9672
Ungheni	12907
Cahul	12908
UTA G g uzia	16051
TOTAL	88183

Source: National Bureau of Statistics [2].

For the academic year 2013-2014, the pass rate for the baccalaureate exams in 6 visited districts is as follows [5]: **Ungheni - 64.03%, Nisporeni – 70.18%, Drochia – 62.74%, Soroca – 48.68%, Cahul – 63.09%, Gagauzia – 55.97%.**

The table below shows the level of teacher training in schools, rating the top ten localities with the highest qualification of teachers in schools:

Table 2

The level of teacher training in schools

Senior degree		I st degree		IInd degree		TOP 10
Locality	%	Locality	%	Locality	%	
Telene ti	10.94	Criuleni	30.51	Ocni a	77.91	I
Soroca	9.28	Telene ti	23.44	Sîngerei	75.54	II
B l i	7.96	Orhei	21.82	Briceni	70.30	III
Chi in u	6.85	Cimi lia	21.62	Flore ti	68.79	IV
Drochia	6.31	B l i	21.14	Rezina	65.75	V
Glodeni	6.14	Ialoveni	21.01	Cantemir	65.22	VI
Calara i	5.71	Rî cani	20.34	Ungheni	65.20	VII
Edine	5.37	Dondu eni	20.00	old ne ti	65.17	VIII
Orhei	5.21	Soroca	17.72	Basarabasca	65.09	IX
Sîngerei	5.15	Calara i	17.71	Glodeni	64.91	X

Source: “Open data on general education” portal [8].

When analysing this issue, one should take into consideration the results of participation in national and international contests/olympiads. Thus, in 2014 Moldovan pupils were awarded 25 medals and 5 endorsements at international and regional competitions in various subjects – one gold medal, 2 silver medals and 22 bronze medals. The best results were achieved at **Mathematics**, pupils from our country gaining 11 medals in international and regional competitions. Outstanding results were achieved at Physics – 3 medals, Ecology – 3 medals, **Computer science – 4**, Chemistry – 3 and Sciences – 2.

Table 3

The results of Olympiads per districts, number of prizewinning pupils

Locality	Total	Computer Science	Mathematics
Nisporeni	8	7	1
Orhei	7	0	7
Criuleni	5	1	4
B l i	5	1	4
Anenii Noi, Varni a	5	1	4
Drochia	4	4	0
Str eni	4	4	0
UTA G g uzia	4	1	3
Ungheni	3	2	1
Hînce ti	2	0	2

Source: Results of republican Olympiads, Ministry of Education orders, 2013 and 2014
www.edu.gov.md

As mentioned above, the desktop research was followed by the survey regarding the establishment of the Network of Excellence Centers in ICT Look@IT. Up to **02.06.2015** were received and analyzed **614 questionnaires**, as shown in the table below, distributed by districts.

Table 4

Number of received questionnaires

Completed questionnaires					
Locality	Local Public Authorities	Directors	Teachers	Pupils	TOTAL
Drochia	0	0	1	1	2
Nisporeni	3	20	26	71	120
Orhei	1	1	2	1	5
Soroca	0	2	3	13	18
Str eni	1	4	2	20	27
Ungheni	6	6	26	272	310
Cahul	1	2	19	80	102
Comrat	0	0	1	29	30
TOTAL	12	35	80	487	614

According to this data, Ungheni holds the first place in the number of completed questionnaires – the proportion of 50.49% of all completed questionnaires, followed by Nisporeni – 19.54%; Cahul –16.61%; Comrat – 4.89%; Str eni – 4.40%; Soroca – 2.93%; Orhei – 0.81% and Drochia – 0.33%. The lack of completed questionnaires in some districts as Drochia, Soroca and Comrat is due to the fact that the meetings organized by ISDI team focused on about the same questions/ideas included in questionnaires, therefore not every participant filled in the questionnaire, but expressed the ideas during discussions. There is a higher degree of survey participation in the districts visited by ISDI team, where detailed discussions took place, and a lower degree in districts that weren't visited and were contacted only by phone and e-mail (e.g. Orhei).

As a conclusion for questionnaires filled in by LPA representatives, most officials (70%) have heard about the Training Centers/Centers of excellence in various areas, including ICT and welcome the establishment of such a center in their locality (100%). During the discussions organized by ISDI team with district presidents and mayors or other LPA representatives (in the visited districts) the same answer was reinforced – openness and support for such IT centers. Thus, **90% of LPA respondents stated that the localities have available premises for the establishment of IT centers**. When asked if population would be interested in such a center and would order the development of ICT applications, all local government representatives reported affirmative answers. **40%** of LPA representatives stated the **problem of lack of IT specialists** and only **10%** said they had a strategy for ICT development.

When asked “Do you want to have an ICT training center in your locality?” **all (100%) high school principals and all (100%) teachers answered affirmatively**. When asked “Are there students interested in ICT in your high school?” the same answers were given by all surveyed principals and teachers. These responses confirm the desire, as well as the need to establish such centers.

As shown in Table 4 most questionnaires were completed by pupils. The pupils have an important role in the project being the main beneficiaries, as confirmed by the goal of Look@IT network (creating opportunities for young high school graduates (as well as other beneficiaries) to obtain e-skills, which could be applied through immediate projects). Thus, **487** questionnaires out of the total of 614 were completed by pupils from V-XIIth grades from 8 analyzed districts (6 of which were visited).

According to pupils responses, about 20% of pupils would embrace IT careers and about 80% would use technologies in other jobs. When asked “Do you want to know more about the opportunities offered by Information and Communication Technology?” the majority – 80.4% responded affirmatively. The question „Do you plan on making an ICT career after graduation?” received an **affirmative answer only from 34.89% of pupils**. Therefore pupils are well aware they will need ICT skills, no matter what careers they will embrace.

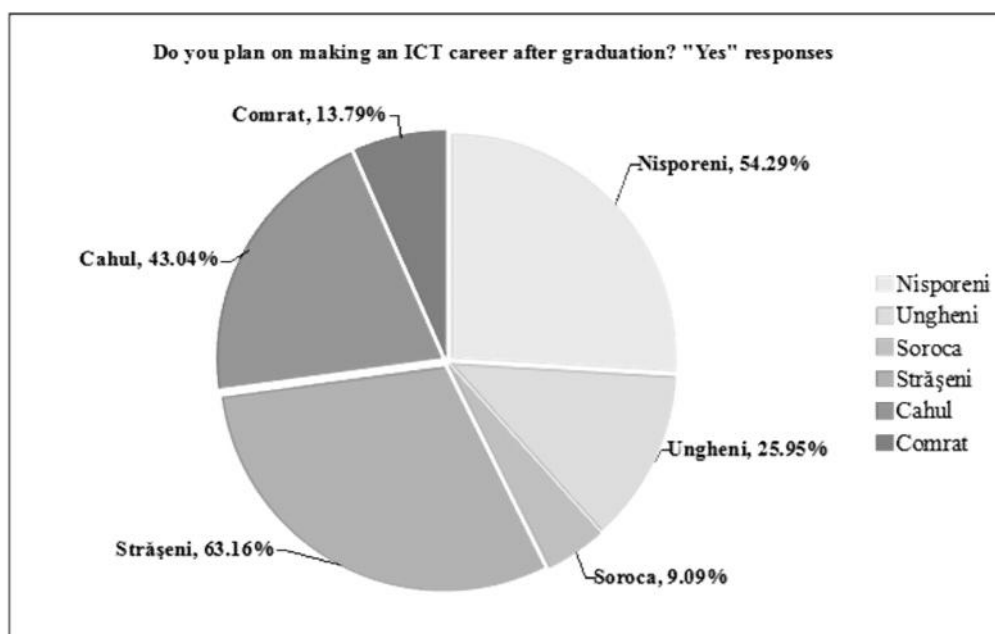


Fig. 1. Pupils responses to the question „Do you plan on making an ICT career after graduation?”

Source: Elaborated by the authors.

The interest of pupils in ICT is confirmed by responses to the question “**Would you like to be in touch with the best ICT professionals? Learn from them?**”. It received an affirmative answer from 90.49% of respondents (Fig. 2).

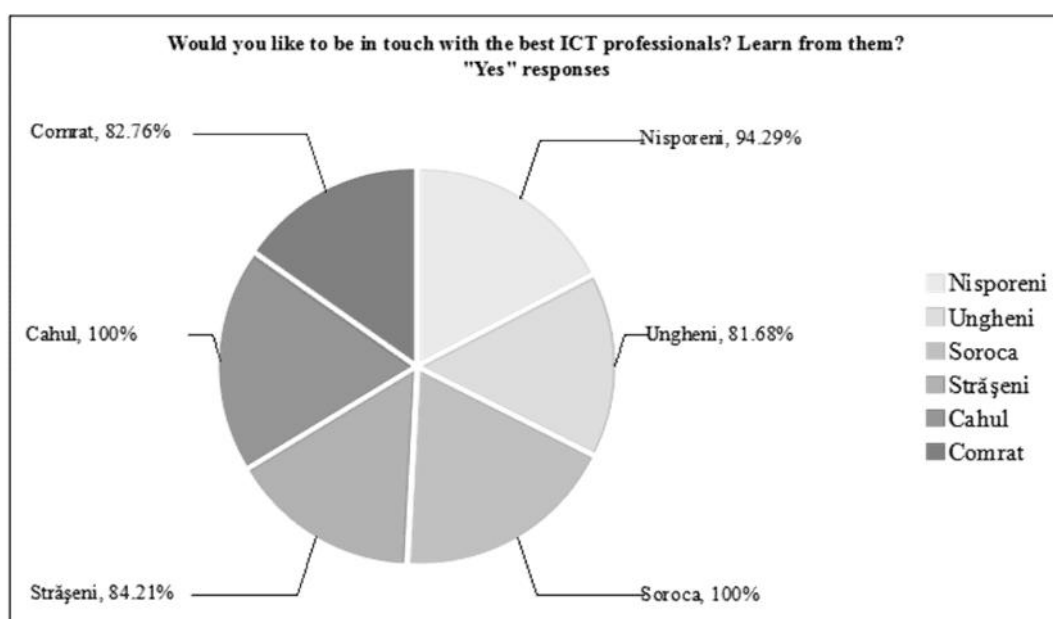


Fig. 2. Pupils responses to the question “Would you like to be in touch with the best ICT professionals? Learn from them?”

Source: Elaborated by the authors.

Adolescence is a time of many changes at all levels: physical, psychological and emotional. This is a time when personality is defined. The fact that the question “What are you good/talented at?” was answered by 19.6% of respondents with a “don’t know”, shows a lack of ability to decide on a career as well as not knowing oneself and one’s own skills/capabilities/talents. Certainly, many of these young people may be drawn into ICT training centers.

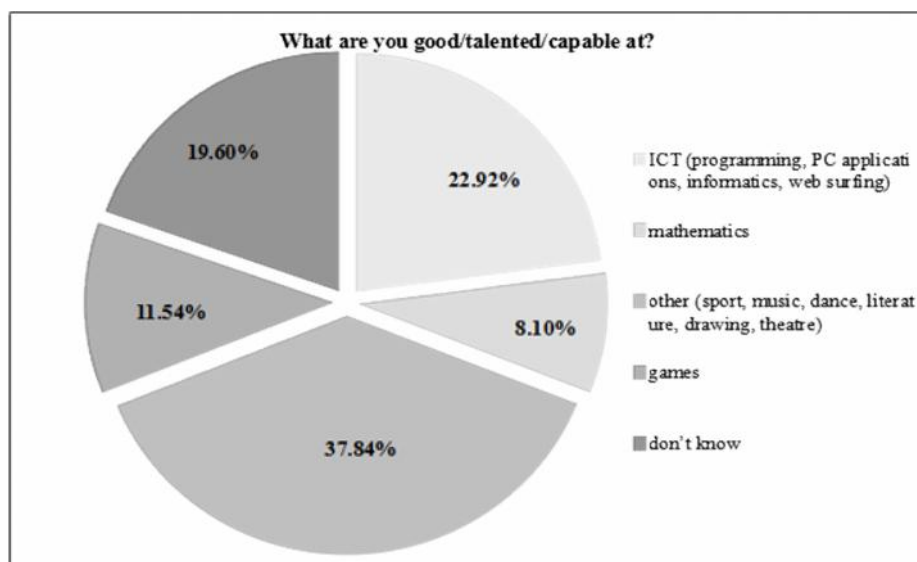


Fig. 3. Pupils responses to the question „What are you good/talented/capable at?”

Source: Elaborated by the authors.

Conclusions

The idea of the project is supported by all participants in the meetings organized by ISDI team. All visited localities expressed political will to participate in the project with contributions in the form of premises, facilities, funding of the 2-3 units in the Center, orders of IT applications necessary for local public authorities. School principals, teachers of computer science are open to participate and contribute to the realization of the idea. According to questionnaire responses, there are virtually no software development companies in the visited districts (except the Deeplace initiative from Tvardia), therefore opening representatives of companies from Chisinau could be the solution to ensure the employability of Centers' graduates.

The pupils are interested in ICT careers, without knowing too many details and without a proper knowledge of the real situation on the ICT market. According to the pupils, the most attractive factor in ICT career is the high salary. Centers of Excellence in ICT could be an alternative to extracurricular activities for the pupils and high school students interested and passionate about technology.

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