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The Direction of Transformation of Information and Communication Technology (ICT) at the Present Stage of Development into an Electronic and Information Society

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ABSTRACT

The modern world has entered a new stage of technological development driven by automation and robotics. New information technologies have given rise to a super advanced communication system that places parties in control of it in a position of great advantage over other users. This has led to what can be called digital inequality. At the state level, misunderstanding caused by communication can lead to severely ineffective planning and cause some nations to be behind others. This study considers how owners of information can distinguish information belonging to them and to others since information is now accessible to all as it is available in a common space. It is necessary for conditions to be set that will be recognised by all parties to prevent new threats to information.

Keywords: Communication technologies, electronic and information society, globalisation, information security

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INTRODUCTION

The threat to information with today's highly advanced communication system may be seen manifested in several forms: creation of virtual worlds that replace

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reality; manipulation of consciousness and behaviour of people; substitution of purposes, values and way of life with externally imposed standards; information distortion etc. These and other threats to information are caused by the individual's need for information, the inability to distinguish between what is true and false and what is useful and useless. This gives rise to the problem of the interaction between consciousness and existence in an information society. The consciousness and existence are found in the general space of information as knowledge, technology and programmes. These are abstract concepts that affect subjectivity. When 'good' and 'bad' are already subjective and abstract, these new realities ushered by today's information and communication technology (ICT) can be destructive if not well managed. According to Subetto (2003),

> ...implementation of market and spontaneous regulation in information spaces as separate societies and a civilization in general. Transformation of information and knowledge into goods led to conscious process of a false information fabrication… The phenomenon of information wars appeared together with formation of the information communities directed to corrupting of social and genetic development mechanisms of separate societies and civilizations, including national and ethical archetypes, the developed systems of values and morality… There is a conscious distortion of information patterns of the world (p. 14).

It is necessary to explore the threats to information by studying available information activities. This will expose the threats and can provide remedies.

Demassification of economic life involves important consequences for the social and political spheres. Forces which supported mass, standardised society will weaken. Individuals and groups become aware of ethnic, religious, professional, sexual, subcultural and personal distinctions. Groups which throughout the Second Wave fought for integration and assimilation into mainstream society refuse to ease tensions by providing explanations for these distinctions. On the contrary, they emphasise differences between groups of people. Nationalism becomes regionalism in a high-tech context. The pressure of the melting boilers of the earlier production society is now substituted with the pressure of ethnic differences in the information society. The environment that succeeded in creating mass culture is now deconstructing it (Vakulenko et al., 2016).

Changes in the social sphere that have led to the emergence of local communities, subcultures and groups of interests have in turn caused significant transformations in policy. On the one hand, complication of social and economic life have led to the democratisation of political life. Toffler developed the concept of 'cargo solutions' to explain the connection. Each society needs a certain number and quality of

political decisions to function. The more and more often it is required to make difficult decisions, the heavier is the political cargo solution. The type of democracy depends less on culture, rhetoric or political will but on the cargo solutions formulated by society. The load can be managed through broader democratic involvement. When cargo solutions in a democracy are extended, democracy is enforced not by choice but by need. The system cannot work without democracy. "We can quite be on a threshold of a new great democratic saltus forward" (Castells, 2000, p. 431).

On the other hand, the same processes destabilise and paralyse the work of developed political institutes (Touraine, 1998; Uebster, 2004; Ursule, 1990). Castell (2000) stated:

> It is impossible to pass at the same time through revolution in power engineering, revolution in technologies, revolution in the field of culture and the world revolution in the field of communications, without having faced – sooner or later – explosion-dangerous political revolution. All political parties of industrial society, all our congresses, parliaments and the Supreme Councils, our presidents and prime ministers, our courts and regulators, our geological beddings of government bureaucracy, in other words, all tools which we use to work out and realize collective solutions became outdated and are ready to conversions. The civilization of the Third wave can't use the political structure of the Second wave (p. 431).

In this case, Toffler remarked, crisis has not affected different societies.

METHODS

This study used the population of St. Petersburg as its subjects to investigate informatisation processes i.e. work and the different types of activity in free time that use information and communication technology. The object of the research was the process of using information and communication technology in the case of social construction of the institutional structures of modern society in daily activities.

The concept of an information society and its revision formed the theoretical basis of this study. This study was also concerned with school informatics as a science and the processes it entails.

We used the theory of social construction of reality developed by Berger and Luckmann (1995) and the principles of the sociology of social knowledge by Schutz as our methodological basis of research. Primary research was carried out in two steps (Kobersy, Karyagina, Karyagina, & Shkurkin, 2015) and the results were obtained empirically.

In the first stage in September-November 2015 a survey was conducted. During interviews with experts in their fields, indicators and criteria of measurement for the second phase of the investigation were specified. In particular, the list of items for

analysis i.e. the options of information use and communication technology for a target sign were specified (Frolova, 2014).

The experts interviewed included teachers, methodologists and principals of educational institutions and governing bodies of St. Petersburg's education systems experts. They were chosen as they widely use information and communication technology (ICT) in the course of their professional activity. We focused on education as it is responsible for socialisation, trained behaviour and the continuity of norms practised by social institutions and the social system in general. More than 30 experts were polled.

The informatisation processes were researched in the second stage during free time in November-December, 2015. The respondents were asked to note the time spent on using ICT for work for a period of one week. The results were processed and analysed using the SPSS software. Interpretation of data was carried out using univariate and bivariate distribution. The research was qualitative and was measured according to cost of free time. Timed interviews were also used for specification and interpretation of results.

The main hypothesis investigated was: "Distribution and use of information and communication technology promotes reproduction of social structures and samples of behaviour in modern society." This entailed the study of the following:

1. The forms mediated by use of information and communication technology were placed in highest priority for satisfaction of needs of social subjects;
2. The use of information and communication technology acquires unconditional social value character and yields samples of behavior and factors of social identification.

The theoretical significance of this research lay in, on the one hand, the contradiction between provisions and forecasts of the theory of information society, and, on the other hand, the actual phenomenon and its ensuing processes. This research will enrich the existing body of research into the mechanisms of interaction between technology (the technosphere) and society (the sociosphere) in modern civilisation.

RESULTS

The value and perspective of using of information and communication technology (ICT) in education are subjects of close attention globally as well as locally. In Russia, the informatisation of education is one of the central focus points of the Priority National Education Project. The universal acceptance of the significance of ICT even led to a declaration made during UNESCO's Second International Congress on technical and professional education: "Precipitancy of development of ICT, their escalating prevalence and accessibility, nature of their maintenance and lowering of their cost have important consequences for training. They can bring to increase in an inequality, weakening of social communications and to bear threat of cultural integrity. Therefore,

the governments need to work out a clear policy for science and technique and to give an assessment to opportunities of ICT and practice of use. At the same time it is necessary to pay attention to how use of ICT will affect support with basic education. Special attention should be paid to those options in case of which application of ICT will promote overcoming of the division resulting from use of digital technologies, to increase in access to education and increase of its quality, reducing thereby an inequality".

UNESCO offers a range of the direction and forms of use of ICT in education. ICT, in keeping within reasonable cost, should be used to support the purposes of education. It has huge potential for the dissemination of knowledge to support effective training and development of qualified educational services. For support of efficiency of ICT, especially in developing countries, it should be combined with more traditional means such as books and radio, and can also be widely used for training teachers. It is necessary to begin to use ICT for improving the collection of data and for analysis; for solidifying of management systems in the field of education at all levels; for ensuring access to education for the people living in remote places and for the needy; for support of original and subsequent professional growth of teachers; and also for support of favourable opportunities of communication that are not restricted to class or other frameworks of culture.

The purpose of informatisation of education is:

1. to stimulate education by means of media and development of educational programmes that will help users to work out the critical and differentiated relation to media;
2. to consider ICT as an educational discipline and as a pedagogical tool in the development of effective educational services;
3. to promote additional opportunities for new generations to learn to use new information technology freely and creatively not only as users, but also as vendors of information content.

The Committee on Education of Administration of St. Petersburg is guided by these requirements to some extent. The chairman of Ivanov's Committee has formulated the following ideology to govern the informatisation of education in St. Petersburg: "Information communication technologies (ICT) which penetrated into all spheres of human activities in many respects define also development of the modern school, namely: the fundamentalization and the advancing character of the development of education aimed at disclosure of creative abilities of the pupil; accessibility of education on the basis of distant training using telecommunication and multimedia technologies. Now ICT are an essential component of educational and educational processes. For the teacher of ICT shall become real means of computer support of educational process in any subject."

School informatics as a component of continuous computer education is aimed at

developing:

1. a broad world outlook (formation of categorical concepts: system, information, structure, property);
2. algorithmic skills (cogitative development of student);
3. vocational training (for school graduates preparing to enter the field of informatics).

The level of education informatisation defines in many respects the process of upgrading education and educational processes. Considerable financial means have been allocated for support of educational institutions in St. Petersburg for informatisation in recent years from the city budget. Analysis of a status of which is carried out by the Committee on Education revealed the following main indices and tendencies. On 1 April, 2005 out of the 86.5% of secondary educational institutions (SEI) of the city, 88% of vocational training centres and 85% of interschool training centres ran 1,239 computer classes (CC), of which the computers delivered in the last three years made up about 40% of the total. On average 1.5 CC is the share of one computer-aided SOU that actively uses computers in its educational process.

Thirty-six pupils are allocated to one computer. This can sometimes average 60 pupils. In St. Petersburg, the figure is slightly higher than that for the rest of Russia. However, in other areas, wide use of computers in the classroom is not yet encouraged. Multimedia projectors (MP) enable the use of new educational technology as well as techniques for large-group teaching. They are also effective for use in conferences, seminars, workshops and other educational settings. In 2007, SEI in the city had about 1,200 MP. Table 1 provides a summary of information on equipment owned by average educational institutions in St. Petersburg.

The Application-Orientated Software (AOS) is regularly used in the educational process, except for teaching informatics and information technology, in about 40% of SEI. In recent years for the first time, 1,378 computer-aided educational sets were purchased. They included software programmes and training in basic use of personal computers as well as computer training for facilitators (computer diagnostics, correction of knowledge and mathematics and Russian for pupils of elementary school). Distribution of AOS in the first stage was carried out as a pilot project in SEI before wider use among other educational establishments in St. Petersburg. The Committee on Education itself bought a significant number of units of AOS in the period 2005-2006. Among the items purchased were software from different companies such as Physicon, Kirill, Mefodiy and INISsoft for teaching mathematics, physics, astronomy, chemistry and biology and preparing students for the Unified State Examination physics papers. Other software were media libraries such as electronic encyclopaedia, ‘Education Media’ and ‘Educational Monitoring’ as well as educational aids such as LogoWorld and FirstLogo.

Almost every SEI that offered computer

classes received this software, which was all licensed for use by teachers and students for the first time in 2005 and 2006. According to records from SEI about 40% of them had operating systems for educational activities (MS Windows 95/2000/XP).

The professional development of teachers in the practical use of ICT in the educational process is necessary due to the significant increase in informatisation in education in the city. In the last three years, advanced training courses for teachers and administrators of establishments of education were organised by various centres such as the Centre of Information Technologies and Telecommunications (CITT), the Academy of Post-degree Pedagogical Education (APDPE), the State University of Informatics, Exact Mechanics and Optics (GU ITMO) and the Regional Center of the Federation of Internet Education (RT FIE). More than 7,000 people were trained in eight split-level training programmes, of whom 30% received funds in addition to the

Table 1
Use of ICT in educational establishments in St. Petersburg

Area	Quantity of SEI that used ICT in their educational process	From them:			% of SEI with CC and using ICT in their educational process	
		>100 hour/ year	50-100 hour/ year	30-50 hour/ year	>100 hour/ year	30-100 hour/ year
Admiralty	24	13	3	8	54%	46%
Vasileostrovski	10	6	1	3	60%	40%
Vyborg			1	7		100%
Kalinin	18	11	3	4	61%	39%
Kirovski	25	18	4	3	72%	28%
Kolpino	11	4	6	1	36%	64%
	77	14	2		64%	6%
Krasnoselsky	15	7	3	5	47%	53%
Kronshtadsky	7	4	2	1	57%	43%
Resort	6	4	2		67%	33%
Lomonosov	3	2			67%	
Moscow			No data			
Nevsky	21	-	1	7		100%
Petrograd	12	3	4	5	25%	75%
Petrodvorets	2		_	2		100%
Seaside	17		6		18%	82%
Pushkinsky	12	2	6	4	17%	83%
Frunze	12	1	4	7	8%	92%
Central	27	16	8	3	59%	41%
Total	283	108	174		38%	62%

budgeted amount (extra budgetary financial means).

The informatisation of education took longer to spread in St. Petersburg than in the rest of Russia in general. The financing of informatisation of education in St. Petersburg is carried out at the expense of the Legislative Assembly, which only receives funding for equipment. The use of ICT in education in St. Petersburg is still sluggish although the city has achieved recognition for its use of ICT, as seen in its nomination to second place for using 'Information Communication Technologies (ICT) in Education' and its being awarded 'The Best Region in the Sphere of ICT'. This is a complex problem that is related to the absence of the wide use of application-orientated software and the lack of human resources. This problem is recognised by the Committee on Education of Administration of St. Petersburg, which has acknowledged that "further development of ICT in education is impossible without solution of the urgent complex tasks connected to the increase of efficiency of use of ICT in the educational process."

A system of indices was created i.e. target standards of informatisation were set to measure the achievement of the region's governing educational bodies. Each index is indicated by a coefficient of achievement. The number of coefficients of achievement from all indices of the process of informatisation of education provides a ratio of effectiveness of use of ICT in the educational process. This is an indication of the complexity of the process of informatisation of education.

These measures were developed for several reasons. The original list of experts were among the teachers who most actively used ICT in the educational process. The region's governing educational bodies

Table 2
Target standards of the informatisation of education in St. Petersburg

Index	Designation	Evaluation criterion	Achievement coefficient
Loading of computer classes (CC): In educational process (EP) >30 hour/week	CC(EP), %	>30% of EI	3
In educational process (unitary enterprise) <20 hour/week.	CC(EP), %	<30% of EI	2
After hours on budgetary basis (AH)	CC(AH/ budget), %	>50% of CC	2
After hours on paid basis (AH)	CC(ah/paid), %	>40% of CC	2
Loading of multimedia projectors (MP)	3(MP) hour/ week	>15 hour/week	3
Percent of KK integrated in the local computer networks (LCN)	K(LCN), %	>85%	1
The number of pupils on one computer (C)	Y(K), pup./C	<50 pupils/C	1
The number of pupils on one modern computer (MC)	Y(SK), pup./SK	<90 pupils/C	1

Table 2 *(continue)*

Index	Designation	Evaluation criterion	Achievement coefficient
Percentage of EI using the information technology (IT) when teaching different subjects (in addition to informatics and technology)	IT(EI), %	>50% of OU	1
Percentage of EI using the information technology (IT) >100 hour/year when teaching different subjects (in addition to informatics and technology)	IT(EI/100)	>30% of EI	2
Percentage of EI connected to the Internet	IT(EI), %	>70% of EI	1
Percentage of EI working on the Internet >50 hour/month in relation to total quantity of OU connected to the Internet	IT(EP/50)	>30% of EI	1

collect and record information on the use of informatisation in the educational process. All institutions are required to fill an information card specifying details subjects, teachers, number of hours, total number of hours of ICT use in the classroom etc. More than 90 such information cards were received from teachers from 52 institutions in the region. They were selected for this research as their work matched the criteria set for this study and they were found to be experts in their field. Thirty-two teachers from seven educational institutions, including comprehensive schools, specialised schools and gymnasia, agreed to participate in this study. The rest were employees of the Scientific and Methodical Centre of the Department of Education and Youth Policy of the Administration of Frunzensky in the district of St. Petersburg.

The subjects were asked to answer in detail the research questions concerning the motive for using ICT in their work; how it was used; the results of using ICT in their work; and the problems and difficulties that arose from using ICT in their work.

None of the experts were offered positive or negative incentives for completing any of the tasks connected with this research. They agreed to make all decisions independently, voluntarily and consciously after understanding the increasing role of subjective-objective factors in gaining the motivation of employees.

The most motivated and responsible teachers were the first to make the decision to implement ICT in the classroom. They were interested in implementing new forms and methods of delivering lessons and using new technologies and types of activity to overcome organisational difficulties and new situations that cropped up in the use of technology. These were often not young employees, but the most skilled and authoritative teachers who enjoyed the support of colleagues and the administration and who were confident in their own ability to use ICT in the classroom effectively even in the face of unforeseen circumstances such as a technical malfunction.

DISCUSSION

Systematic research in this direction has been carried out since the 1960s in line with new American sociology. Parsons (1996) formulation of the "component" or "sphere" theory of a social system modelled the dialectic interaction of a "technosphere" featuring engineering and industry, which he termed the "technological belly," as the prevailing power sources and a "sociosphere" in which attention was paid to reviewing different forms of people organisation, social communication and public consciousness (Stouner, 1986). Analysis of such interaction that was presented in macro sociological theories referred to a "post-industrial" (Toffler, 2004, p. 669; Toffler, 1999, p. 781), "technetronic" (Toffler, 1997, p. 461) or "information" (Masuda, 1983, p. 29) society.

Throughout the 1970s this theory, which enabled prediction of the direction of restructuring of the economy of developed countries, enjoyed wide popularity both in society in general and in the academic environment. Different aspects of the theory, which was generally termed 'post-industrialism', were developed by authors such as Bell, Touraine, Brzezidski, Masuda, Stovner, Toffler, Herbert McLuhan, Porat and Castells. They specified, rather accurately, these basic features as those of the post-industrial society:

1. Innovative theoretical knowledge becomes a defining factor of public life in general. It cancels work and capital in their role as factors of cost. The economic and social functions of capital pass to information. As a result, the university as centre of production, processing and accumulation of knowledge becomes a kernel of the social organisation, the principal social institution. The industrial corporation loses its predominating role.
2. Level of knowledge, but not property, becomes a defining factor of social differentiation and professional structure is more important than class. The main conflict happens not in the economy but in the cultural sphere where there is conflict between the representatives of the old culture and those of the new. The result of the conflict and its resolution is the development of new and decline of old social institutions.
3. The infrastructure of this society is intellectual, and not mechanical. The social organisation and information technology form a symbiotic relationship. Society enters 'a technetronic era' in which social processes become programmable.
4. The prevailing 'tertiary' sector of the economy (a sector of services) and information business stand apart and grow, becoming a 'quaternary' sector of economy.

In the early 1980s, there was a synthesis of the concepts of 'post-industrialism' and 'information society', which originated

in Japan. The two main theorists of these concepts were Bell in *Social Frames of Information Society* (Bell, 1980, p. 426) and Masuda in *The Information Society as Post-Industrial Society* (Masuda, 1983, p. 29). The American sociologist, Manuel Castells, was the most significant theorist of the information paradigm. His fundamental three-volume paper, "Information Era: The Economy, Society and Culture", (Castells, 2000, p. 431) advanced this theory among leading sociologists around the world at the beginning of the 21st century. He advocated saving the major characteristics of capitalism and introduced the term 'information capitalism', an ideology that called for the building of networks to connect people, institutions and the state as a means of overcoming the economic and cultural contradictions of capitalism and social conflicts. The information society was deemed to be the most progressive social system.

Analysis of the social role of communication technologies became later one of the main directions in research into postmodern ideologies and researchers paid special attention to the phenomena of culture and the mass media, claiming that changes in these spheres promote new behaviour. The leading authors of this direction were Vattimo, Poster and Baudrillard while Lash and Bauman focused on the social problems of postmodern society and local researchers like Antonovich and Dudchenko studied the new social system expressed in terms such as 'post-modernist' and 'character reference'. Other researchers like Etzioni, Delanty and Reingoldt were engaged in studying virtual communities and computer-mediated forms of social interaction at the beginning of the 21st century.

Among the local authors who wrote on the information society were Abramov, Anurin, Borisov, Buzgalin, Voronina, Inozemtsev, Kostiuk and Rakitova. The Internet Pak as a wide information and communication area network became the source of such research especially that by Chugunova, Sokolov, Sibirev. These writers analysed the key postulates of foreign authors.

Bill Gates, the founder of Microsoft Corporation offered technological approaches. In the book *The Road Ahead* he claimed, "computer technologies are the most essential factor influencing change of the world today". However, many researchers believed it was not the result of sociological speculations, but a marketing mix which reduces diversity of information factors of social development to the phenomenon appearing entity of one of the most profitable goods of the present for the purpose of gain of monopolization of a technological sector of the information market" (Lopatina, 2006, p. 201)

CONCLUSION

The bulk of local research into this field has been carried out by scientists and organisations specialising in technology, cybernetics and the economy such as The Institute of Systems Analysis of the Russian Academy of Sciences, The Institute of Automatic Equipment and Automation

of the Russian Academy of Sciences and The Institute of Social and Economic Problems of the Population of the Russian Academy of Sciences etc. It exerted a certain impact on the methodology used in this research, resulting in the creation of specialised administrative structures (The Institute of Development of Information Society in Case of the Government of the Russian Federation) and government policy in the field of informatisation, for example, "The Concept of Formation of Information Society in Russia"). At the same time, American sociologist, Castells' ideas were adapted for use such as in "The Concept of Transition of Moscow to Information Society". The technocratic post-industrial approach was gradually implemented in Russian academic and political practice. This was characteristic not only of Russia, but also of a number of international organisations. At the same time, the promulgators of the concept of the information society considered it a type of social system that was new and possible only in the future. The Declaration of the World Congress of UNESCO on the status of creative specialists in Paris in June, 1997 began with this preamble: "As the modern society already is information society, business of the creative specialists directed in the future to plan circuits of the new union connecting ethics, technology and an esthetics".

Predictions of a forthcoming complex change in lifestyle were seemingly supported by the progress of computer technology, and this presented the opportunity to effectively integrate the technologies of communication and information processing that Toffler had referred to in "Morphing of the Power" (Toffler, 2004). However, this approach faced critical problems in meeting the empirical criteria of determining what an information society was. For example, how would ICT growth and use in an information society be measured? Did the emergence of a new society indicate also the emergence of ICT? How widespread a use of ICT was necessary bring this society into being and what was the necessary volume of its distribution?

There were also serious objections are against technological determinism that defined the whole of society based on one of its external factors, as technology and technical devices are part of the society. Society is not able to respond to different menaces at the same time nor is it able to adequately perceive and comprehend these menaces owing to misinformation and change. Therefore, there is a need to define the social aspects that regulate information danger and safety in modern, especially–Russian, society.

Danger to the existence of society is connected to imbalance and the rupture of internal communications in the public system. Therefore, safety can be understood as restoration of internal unity, integrity of this society, saving of the ability to work out relevant to objective needs of purpose and ability and their possible achievement. Therefore, the scientific analysis of public processes is impossible without an understanding of the definition

of danger and safety, and, above all, the information society.

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