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COUNTRY DEFINITION AND DIRECTIONS' CHOICE OF INTERNATIONAL COOPERATION IN THE ICT DEVELOPMENT

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Abstract

The research subject is the effective use of information and communication technologies (ICT) in the United States, China, India and Russia. Country definition and directions of international cooperation of Russia in the field of ICT development is the aim of study. Digital economy is unthinkable without use of modern ICT. ICT influences economic growth ranging from increased investment in ICT-using and manufacturing sectors to their implementation in organization's coordination mechanism with the outside world. The article reveals weak positions of India and China in relation to Russia. According to cluster and neural network analysis we found out groups of countries and favorable cooperation directions. The first group is India, Russia and the United States, the second one is India, the United States and China. Russia can have equal cooperation in effective use of ICT with India and the United States. Potential of mobile cellular communication is the prospect for international cooperation between Russia and India. To develop information society in Russia it is necessary to establish foreign trade relations with the United States on high-tech products. It will increase the level of technology of Russian firms and create incentives for China and India in international cooperation with Russia. Russia is an active user of ICT, but they are based on foreign developments. Nowadays we don't have domestic analogues. The widespread introduction of foreign ICT, including at critical information infrastructure facilities complicates the task of ensuring protection of citizen interests and the state in information sphere.

Keywords: Information, communication technologies, cluster, neural network.

1. Introduction

In the last decade, the digital world has been developing quickly. Using of information and communication technologies (ICT) is a necessary condition for the formation of digital economy (Makarov, Bakhtizin, & Burylina, 2017).

Nowadays, there are so much of people's daily interactions which depend on technology and its functions. Now it's so profitable than ever to have skills in using ICT for effective communications, researches, and interacts with other people (Poole, 2009). The use of ICT contributes to achievement a specific goal (Westerterp-Plantega, 1999).

Substitution of ICT inputs contributes to the reduction of energy consumption in production (Zhou, Zhou, & Wang, 2018), by implementing the technological foresight (Li, Chen, & Kou, 2017).

There are two main channels of ICT influence on economic growth. First, investments in ICT stimulate the growth of economic and manufacturing industry. Second, there is an indirect impact of ICT on the overall productivity growth of production factors and in ICT-using and ICT-producing sectors (Erumban & Das, 2016).

Significant attention is paid to use ICT in a form of group decision support systems. The ICT has a multifaceted impact on the organization's coordination mechanisms with the outside world (Nouwens & Bouwman, 1995). Over the past decade, the ICT sector had undergone significant changes in demand and supply. The use of ICT is growing exponentially by increasing demand for data and a clear decline in the consumption of traditional service of voice and short messages.

Innovations of devices, technical progress and price reduction enable you to extend connectivity. However, prices are still the main barriers in developing countries. In addition, there are people who do not use the Internet because they do not see the need and lack of knowledge about ways of using it. It indicates not only a gap in accessibility, but also a lack of understanding of benefits.

2. Problem Statement

Nobel Peace Laureate 2009, the 44th President of the United States (20.01.2009 – 20.01.2017) Barack Hussein Obama II in cooperation with the Council of economic consultants announced in front of the Congress an economic report. In this report he pointed to the growth of public investments in infrastructure, education, training, energy and information technology in health care by 37 percent. The report discusses government measures to create jobs in high-tech, with the active use of ICT, health, manufacturing and the financial sector. At the same time, it is indicated that the main driver of productivity growth in the period 1995-2005 was innovation in the field of information technology.

At the same time, the current US President (since January 20, 2017) Donald John Trump isn't accepted by citizens who are closer to the high-tech industry. At the time, almost all the States of the West and North-East coast, as well as the rich Illinois by universities and laboratories voted against Trump. The main economic policy of Trump was the return of tech companies in the United States. To encourage this phenomenon, Trump proposed to reduce the corporate tax from 35 to 15%, which would improve the investment climate in a region and contribute to the growth of high-tech startups.

The head of China, Secretary General of the Communist party of China, Chairman of the people's Republic of China, Chairman of the Central military council of China XI Jinping called putting the country to the forefront in the world in terms of product quality, transport communications, digital technologies.

The current President of India, Ram Nath Covind is less active in government policy to use ICT in the economy. He tries to pay more attention to develop national culture. Pranab Kumar Mukherjee, 13th President of India (2012-2017) has ensured that India has become a leader in implementation of technological infrastructure ("boom" startups, record investment in 2015, Google has trained two million Indian developers). Using the capabilities of the technological infrastructure, Apple has opened production of smartphones in India.

India clearly doesn't seek to take a leading position in the use of ICT. Russia has consistently aimed at the formation of national digital economy.

3.   Research Questions

The Federal law "On the Information, information technologies and information protection" is a start of the formation of Russian digital economy which requires the regulation of relations in the exercise of the right to search, receive, transfer, production and distribution of information; the use of information technology; information security.

The second stage is the decree of the Russian President "On the Strategy of development of the information society in the Russian Federation for 2017 – 2030", which already defines goals, objectives and measures for the implementation of domestic and foreign policy of the Russian Federation in the field of information and communication technologies. It's aimed at the development of information society, the formation of national digital economy, ensuring national interests and implementation of strategic national priorities.

The third stage is the decree of the Russian President "On measures to optimize the structure of the presidential Administration of the Russian Federation" which aimed at the development of ICT and communication infrastructure. A new Management structure should ensure activities of the President of the Russian Federation on state policy in the field of digital infrastructure development, as well as on the use of information and communication technologies.

The study of the current legislation and challenges of the digitalization is the goal of this paper.

4.   Purpose of the Study

As described above, Russia has the most active state influence on using of ICT. The United States and China are using economic incentives, but Russia is actively using institutional mechanisms to transition to digital economy. The scientific approach to evaluating the progress of the digital transformation in Russia as well as figuring out the most relevant trend of the digitalization of the Russian economy is of a key importance for policy and decision-making.

5. Research Methods

The methodology of the research is related to analytical knowledge of ICT using to improve productivity and collective efforts to achieve common goals (Steinmueller, 2000; Straub, 2008) also to assess the impact of demographic characteristics on ICT using (Kwon & Zweizig, 2006). The fourth industrial revolution (Industry 4.0), actively uses advanced ICT. It continues to deploy a modernized power system to manage the growing demand for energy (Faheem et al., 2018). Rational implementation of requirements of the 4.0 Industry is possible with certain skills in ICT (Lee, Kogler, & Lee, 2018; Amendola Calabrese, Caputo, & Fabrizio, 2018) and motivations (Lee, Lee, & Hwang, 2015; Malaquias, Malaquias, & Hwang, 2016; Yu, Lin, & Liao, 2017).

Cluster and neural network analysis can assess the use of ICT and the possibility of cross-country interactions. Cluster analysis displays features of multidimensionality in the classification procedure of phenomena (objects) (Wu, Wang, & Zou, 2018). The clustering process and results depend on the chosen method and ways of defining the distance measure. A hierarchical method of cluster analysis reveals sequential integration of smaller clusters into large ones. Hierarchical agglomerative methods are characterized by a consistent union of the initial elements and a corresponding decrease in the number of clusters.

The cluster analysis unites groups of phenomena with the minimum distance between them. There are different rules for determining the distance between clusters. It's called methods of integration or link for two clusters. To give greater weights to objects with big distance from each other in a research we use the distance measure, which is called "Euclidean distance square".

The simulated neural network in "SPSS Statistics" will allow to establish the importance of ICT usage indicators. A neural network is a set of analytical methods implemented on hypothetical principles of learning that allow predicting values of variables. A neural network requires the exact type of connections between inputs and outputs. The relationship between input and output is in the process of learning the network ("learning with a teacher" or "without a teacher"). In a research is used a "learning with a teacher" with architecture "multi-layer perceptron (MLP)" ("SPSS Statistics – "Neural Networks"). In the learning process are applied tools for recognizing important variables. Therefore, it is possible to use unknown variables.

Neural networks of the most frequently used architectures produce output values in a certain range (in the interval [0,1] or in the value of normalized importance from 0 to 100%)..

6. Findings

ICT development index. The ICT development index is calculated according to the methodology of the International telecommunication Union (ITU), it's a specialized unit of the United Nations which defines the world standards in ICT. The index was developed in 2007 on the basis of 11 indicators used by the international telecommunication Union in its estimates of ICT development.

These indicators concern access to ICT, use of ICT and practical knowledge of these technologies among countries population covered by the study.

In the study of 2017 ITU is presented data of 176 world countries by the end of 2016 (see table 1).

Table 01. World development index ICT (International Telecommunication Union: The ICT Development Index 2017).

Rating	Country	Index
1	Iceland	8,98
2	South Korea	8,85
3	Switzerland	8,74
…	…	…
16	United States of America	8,18
…	…	…
45	Russia	7,07
…	…	…
80	China	5,6
…	…	…
134	India	3,03
…	…	…
176	Eritrea	0,96

Source: ICT Development Index. URL: https://www.itu.int.

The ranking index of ICT development on the world (table 1) shows quite weak positions of India and China. Russia is closest to the USA, which is located on the 16th place. The United States ($ 58952.03 per capita) is second only to countries with a small population of Iceland ($ 60920.39), Switzerland ($ 79347.76), Norway ($ 72046.29) Luxembourg ($ 108004.9) and Luxembourg ($ 108004.9) in 2017 in terms of GDP per capita.

The share of ICT in GDP per capita is not significant and there is still potential for growth in the United States. Switzerland can become a benchmark with a sufficiently high place in the ICT rating and the level of GDP per capita.

Cluster and neural network analysis. We will conduct a cluster and neural network analysis of projected growth rates of their economic development indicators to determine possible options for Russia's strategic partnership with India, China and the USA until 2023.

Priorities of importance (more than 0.02) and proximity (square Euclidean distance less than 1.0) as a result of cluster and neural network analysis of projected growth rates of economic development indicators of India, China, Russia and the USA (table 1) are identified.

1) there are following countries and their respective indicators by importance (more than 0.02):

- India ("Gross public debt as % of GDP", "Government Revenues, % of GDP", "Total government expenditure, % of GDP", "Total investment", "Exports of goods and services", "GDP growth in constant prices, %", "Structural budget balance, % of potential GDP");

- China ("Gross national savings", "Government Revenues, % of GDP", "Imports of goods and services", "Structural budget balance, % of potential GDP");

- Russia ("Current account Balance, % of GDP", "Total government expenditure, % of GDP", "Total investment", "Exports of goods and services", "Unemployment rate");

- USA ("Gross public debt as % of GDP", "Government Revenues, % of GDP", "Total government expenditure, % of GDP", "Structural budget balance, % of potential GDP", "Unemployment rate", "Net public debt, % of GDP");

2). there are following countries and their respective indicators by proximity (square Euclidean distance less than 1.0):

- China and Russia ("Unemployment rate");

- China ("Gross domestic product (GDP) deflator") and USA ("Gross domestic product (GDP) deflator", "Net public debt, % of GDP");

- India ("Government Revenues, % of GDP", "Total government expenditure, % of GDP") and China ("Unemployment rate", "Government Revenues, % of GDP");

- India ("Gross national savings") and USA ("Gross national savings");

- China ("Government Revenues, % of GDP", "Total government expenditure, % of GDP", "Gross national savings", "Total investment");

- Russia ("Government Revenues, % of GDP", "Total government expenditure, % of GDP").

Priorities of economic development of India, China, Russia and the USA (2019-2023) allow us to identify the most favorable strategic areas of cooperation:

- India and China ("Government Revenues, % of GDP");

- India and Russia ("Total government expenditure, % of GDP", "Total investment", "Exports of goods and services");

- India and the USA ("Gross public debt as % of GDP", "Government Revenues, % of GDP", "Total government expenditure, % of GDP");

- China and the USA ("Government Revenues, % of GDP", "Structural budget balance, % of potential GDP");

- Russia and USA ("Total government expenditure, % of GDP", "Unemployment rate").

We can notice the next groups of countries for favorable cooperation:

- India, Russia and USA ("Total government expenditure, % of GDP");

- India, USA and China ("Total government expenditure, % of GDP").

Therefore, we have Russia and China, which cooperate with a large margin in one direction. China imports hydrocarbons. Russia can count on equal cooperation for effective use of ICT either with India or with the United States. The USA is a higher priority for Russia in this case.

We will identify priority areas of cooperation between Russia and India, China and the United States using data of «2018 - The Little Data Book on Information and Communication Technology. International Bank for Reconstruction and Development / The World Bank» (see table 2).

Table 02. Priority areas of Russia's cooperation with India, China and the United States.

Indicators	India	China	United States
Economic and social context Population (millions)	+		
Urban population (% of total)			+
GNI per capita, World Bank Atlas method ($)			+
GDP growth, 2005–10 and 2011–16 (avg. annual %)		+	
Adult literacy rate (% ages 15 and older)			+
Gross primary, secondary, and tertiary school enrollment (%)		+	
Sector structure Separate telecommunications/ICT regulator	+		

Indicators	India	China	United States
Status of main fixed-line telephone operator			+
Level of competition (competition, partial comp., monopoly)			
International gateway(s)			+
Mobile telephone service			+
Internet service			+
Foreign ownership (not allowed, restricted, allowed)			+
Reg. treatment of VoIP (banned, closed, no framework, allowed)			+
Sector efficiency and capacity Telecommunications revenue (% of GDP)			+
Telecommunications investment (% of revenue)		+	
Sector performance			
Access Fixed-telephone subscriptions (per 100 people)			+
Mobile-cellular telephone subscriptions (per 100 people)			+
Fixed-broadband subscriptions (per 100 people)			+
Households with a computer (%)			+
Households with Internet access at home (%)			+
Usage Int'l. voice traffic, total (minutes/subscription/month)			+
Domestic mobile traffic (minutes/subscription/month)		+	
Individuals using the Internet (%)			+
Quality Population covered by at least a 3G mobile network (%)			+
International Internet bandwidth (bit/s per Internet user)			+
Affordability Mobile-cellular sub-basket ($ a month)			+
Fixed-broadband sub-basket ($ a month)			+
Mobile-b'band, prepaid handset-based, 500 MB ($ a month)			+
Mobile-b'band, postpaid computer-based, 1 GB ($ a month)			+
Trade ICT goods exports (% of total goods exports)		+	
ICT goods imports (% of total goods imports)		+	
ICT service exports (% of total service exports)	+		
Applications Online service index (0-1, 1=highest presence)			+
Secure Internet servers (per million people)			+

Source: 2018. The Little Data Book on Information and Communication Technology. International Bank for Reconstruction and Development / The World Bank, 1818 H Street NW, Washington DC 20433, Telephone: 202-473-1000, Internet: www.worldbank.org. International Telecommunication Union (ITU).

Data of table 2 reveal the main areas of Russian cooperation:

- "limited" with India: population; separate telecommunications regulator; export of ICT services;

- "average" with China: GDP growth; primary, secondary, tertiary use in schools; investments in telecommunications; home mobile traffic; ICT exports and imports of goods;

- "wide" with the USA: urban population; GNI per capita; adult literacy rate; status of the main fixed telephone operator; international gateways; mobile telephone service; Internet service, etc.

It should be noticed that identified areas of Russian cooperation in the use of ICT correlate with ICT development index (table 1).

Russia is of interest to India, China and the United States in using of ICT only with mobile cellular communication. Information society is characterized by a wide spread and availability of mobile devices (on average, one Russian has two mobile phone numbers), as well as wireless technologies and communication networks in Russia.

Thus, we have possibility of rational ICT using with American technologies despite all political and economic differences between the United States and Russia

We will have quite low development of Russian digital economy without participation of the United States despite the established legal framework (Federal law "On information, information technologies and information protection", Decrees of the President of Russia "on the Strategy of development of the information society in the Russian Federation for 2017-2030" and "On measures to optimize the structure of the presidential Administration" for the development of ICT and communication infrastructure).

China and India will not be able to maintain sufficient efficiency in use of ICT in Russia. It should be noted that they are more dependent on the United States in the field of ICT than Russia.

Therefore, Russia needs to establish foreign trade relations with the United States on high-tech products for development of information society in Russia, taking into account strategic principles of its functioning (forms of obtaining goods and services; priorities of traditional Russian spiritual and moral values and compliance with the norms of behavior in using ICT; ensuring the legality and reasonable sufficiency in collection, accumulation and dissemination of information about citizens and organizations; ensuring state protection of interests of Russian citizens in information sphere).

On the one hand, it will improve the technological level of Russian firms by reducing costs in production of goods and services. On the other hand, it will create new incentives for China and India to strengthen international cooperation with Russia.

Russia adopted "Strategy of information society development until 2030". It's aimed at securing national interests in development of information society. It will be achieved through: development of information space tailored to needs of citizens and companies in obtaining quality and reliable information; development information and communication infrastructure; creation and use of Russian ICT and competitiveness at the international level; formation of a new technological basis for development of economy and social sphere; ensuring national interests in the digital economy.

7. Conclusion

Vladimir Putin, Barack Obama and XI Jinping noticed the key role of ICT in economic development. XI Jinping has an active position in the use of ICT but according to the ranking on the ICT development, China has rather weak position. Russia is the closest to the United States.

According to cluster and neural network analysis we found out groups of countries and favorable cooperation directions. The first group is India, Russia and the United States, the second one is India, the United States and China. Russia can have equal cooperation in effective use of ICT with India and the United States.

Russia is of interest to India, China and the United States in use of ICT only with respect to mobile cellular communication. The United States and Russia have political and economic differences, but possibility of effective use of ICT is associated with American technologies.

China and India will not be able to maintain sufficient ICT efficiency in Russia in the short term.

They are more dependent on the United States for ICT use than Russia.

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