

DETERMINATION OF THE EFFECTIVENESS OF INVESTMENTS IN ICT USING A COMBINATION OF FUNCTIONAL AND RESOURCE ASSESSMENT CRITERIA

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Abstract

Analysis of modern literature allows us to assert the following problem: industrial enterprises do not have a universal mechanism for assessing the information and communication potential, which is necessary for the implementation of the forthcoming financing for the development of digital technologies in a given company. The aim of the study is to develop a combined approach for managing the efficiency of investment in information and communication technologies of an enterprise, which contains a set of resource and functional evaluation criteria. Applying the method of factor analysis, using a combination of functional and resource assessment criteria, an effective indicator of information and communication potential was calculated in the study on the example of enterprises in the entrepreneurial sector of the Kaluga region. The authors put forward a hypothesis that the discrepancy between the functional and resource criteria for assessing the investment potential of a territory is due to the type of regional development. In a study based on

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empirical data obtained as a result of a survey of IT sector employees of 46 enterprises in the entrepreneurial segment of the Kaluga Region (Russia), it was confirmed that the discrepancy between resource assessment criteria and functional criteria, is due to the extensive type of regional development of the Kaluga region, which is characterized by an orientation towards increasing the attracted resources in value-added processes rather than increasing their levels of efficiency.

Keywords: information and communication technologies (ICT), assessment, resource criteria, functional criteria, investment, investment potential

JEL code: M15, M21, O32

1. INTRODUCTION

The investment attractiveness of information and communication technologies is due to the following factors: growth prospects, high return on investment, and attractiveness from the position of employment. This has been proven by specific studies carried out in 2005 (Whale, 2005), and is confirmed by the current statistical data reflected in the rating of countries of the world by their level of development of information and communication technologies (Rating of countries of the world by the level of development of information and communication technologies, 2020). However, in addition to this, improving tools for assessing the information and communication potential of an enterprise is important, especially because the new approach has great advantages based on a combination of resource and functional assessment criteria, making it possible to increase the degree of objectivity.

The current global movement of

socio-economic systems into an information society (IS) indicates that there is a development and acquisition of new forms of relations in the political, economic, and social spheres. New information resources have a leading role in the production systems of not only countries with developed economies, but also in the socio-economic life of developing countries. Information becomes the most important resource, forming the basis for production in an information society. In this regard, the information economy is interpreted as a production system, combined with the sphere of consumption, where information is perceived as the leading productive force (the decisive means and the subject of labor), as well as being the main product of production and the subject of consumption.

The emergence of a new information society raises questions, disputes, and discussions, confronting society with a host of social and economic problems. In 1997, the Partnership for Global Knowledge

program was created in Malaysia, with members including more than 80 participants from 38 countries around the world (Melnik & Degtyareva, 2005).

Using the definition given by the Partnership for Global Knowledge, the term “information society” refers to a society in which there is free access to information and knowledge, contributing to sustainable development and progress (Gester & Zimmermann, 2005). The information society is characterized not only by free communication between the government and citizens, and between citizens of the whole world, but also by the fact that every citizen is aware of current events in the country (and in the world). The term “information society” has come into use along with information and communication technologies - the Internet, e-mail, and mobile phones, which are now an integral and deterministic part of our lives.

At the Geneva summit, one large-scale event held under the auspices of the UN, the main principle of the information society was approved - the introduction of new information and communication technologies (ICT) in all spheres of social, economic, and political life, in order to create a single information world (World Summit on the Information Society. A Compendium of Materials, 2003).

The modern economic space is characterized by a high level of communications, which occupy a leading place in it. The study and generalization of various approaches

to the definition of the term “communication” allows us to distinguish two main theses, or meanings, regarding this phenomenon:

1. Communication is a technology, method, or means for creating the ability to exchange information between entities through channels of information transfer.

2. Communication is the direct process of information interaction between the sender and recipient of information.

Prominence is also given to the assessment of the effectiveness of investing resources in information and communication technologies (ICT). The determination of a quantitative indicator of the effectiveness of the use of investments is influenced by various factors: uneven provision of resources, and the non-optimal nature of their use. A systematic approach is required, based on a combination of resources and factors, making it possible to form a mechanism for managing the effectiveness of investments in ICT, and to make the best investment decision.

2. LITERATURE REVIEW

In the modern economic space, communication plays a central role. Even the name of a company carries information, which is a message to potential clients.

Without clarifying the nature, essence, and content of the category "communication", it is not possible to analyze the investment value of information and communication

technologies with a sufficiently high degree of objectivity. Further in the study, the social conditioning of communication interactions between various groups of subjects is analyzed within the framework of a literature review.

Various types of organizational communications are known, among which the following types are worth highlighting (Nazarchuk, 2009).

- internal corporate communications, that is, communications between company employees;
- business communications, which include communications with contractors of the organization;
- social communications aimed at potential consumers of enterprise products.

In this case, advertising and marketing in general and in the most complete way are included in social communications.

Considering the basic understanding of social communication, it should be noted that communication (social communication) should be understood as an effective synchronous and diachronous

interaction of social subjects (people and (or) their communities), the essence of which is the movement of meaningful information (communication substance or message in an ideal or ideal material form) from one subject (source) to another (recipient) (Agi, 2004).

The main distinguishing features of communication are as follows.

1. For the emergence of communication, at least two objects are necessary, and these objects must belong to society (i.e. people and their groups).
2. Between these entities there should be a sending or exchange of messages containing significant information. Moreover, the implementation of communication requires the ability to decode the message.

As a result of communication between subjects, there is a movement and exchange of information.

In his model, Harold D. Lasswell (Bulkina, 2000) most fully discloses all the elements that make up communication (Figure 1).

When comparing the Harold D. Lasswell model with the traditional

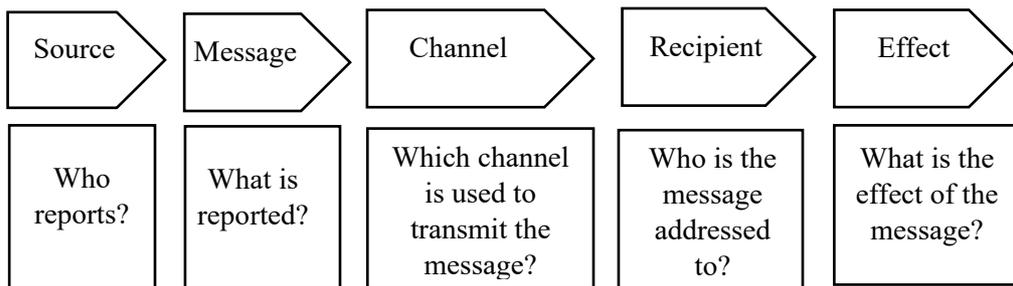


Figure 1. Harold D. Lasswell, Communication Model

two-way communication model that is most often found in educational literature (Nazarchuk, 2009) and which also includes elements such as the sender, the message itself, the channel, the receiver, feedback, and sometimes noise, we can conclude the following. To highlight the main difference, the former model includes not only feedback as such, but also the effect of the transmitted message, which is evaluated directly using feedback.

Thus, the structure of communication involves the inclusion of the following elements:

- two participants (people or their society) who know the norms of a semiotic system, for example, language or the possibility of translation;

- a common topic, interest or situation, possibly specially provoked by one of the participants in communication, which is fundamental in communication;

- text or other encoding of the transmitted information;

- the purpose, motive, and meaning of the interaction of the communicators;

- material transmission of the text, that is, the creation of conditions under which the recipient of information will be able to receive it.

2.1. Communication in the Concept of Social and Communicative Technologies

More broadly, social technologies are considered as a certain activity of the subject which is

based on a specific action program aimed at solving social problems, and which is a system of various procedures, actions and the use of various means and social resources for the complex solution of a certain socially significant problem (Konovchenko, 2001).

Given this definition, social-communicative technology can be described as a purposeful systemically organized activity for managing the communication of a social subject, based on a specific plan (program of action) and aimed at solving any socially significant problem.

Consequently, it is advisable to define the applied term of “social and communicative technology” as a systemically organized set of operations, structures, and procedures, that rely on a program (plan) to achieve the goal of a social subject through controlled social communication (Ustinova & Khayrullina, 2015).

The above definitions are equivalent to each other and characterize the defined phenomenon with varying degrees of completeness.

One type of social and communicative technology is PR technology. PR technology is a communication technology aimed at managing the external and internal communications of a company or structure with its target group in the public (Chumikov & Bocharov, 2009).

The object of social communication technology (SCT) in the broad sense is social space and society. In a narrowly applied sense,

the object can be recognized as the subconscious, perception, reaction, or attitude of social subjects to the source of communication. In the scientific literature, the subject of social and communicative technology is the systematic process of managing communication objects, organized on the basis of communications (Chumikov & Bocharov, 2009).

Thus, we can conclude that social communication is a tool, a means, and a way to achieve the goal of influencing the object of communication.

Therefore, the subjects of SCT can be social institutions and social organizations.

The following can be distinguished as common features of subjects and tools of social and communicative technologies:

- focus;
- structuring, delimiting, dividing an object into elements;
- operations, stages, phases;
- coordination and phased actions;
- the unambiguity of the procedures and operations.

Thus, we can conclude that social and communicative technologies are a complex and multifaceted process, the achievement of the goals of which, requires serious effort and well-coordinated actions.

The main types of communications include:

1. One of the central roles is media relations. At the state level, this is the universal broadcasting of messages from authorities, in particular the government, the

president, the State Duma, or the Federation Council.

2. Communication with the population. This technology is implemented in order to provide support by the local authorities to the population (for example, personal meetings with the population, visits to commercial and municipal enterprises, personal speeches of government representatives).

For example, communication with the population is carried out through:

- organizing public hearings on issues of significant public interest within a separate municipal entity of the region (Khludnev, 2019);
- conferences with the participation of authorized representatives of local and regional authorities.

Modern researchers note the special role of Internet technology in organizing the interaction of power and the population. "It is Internet technologies that are called upon to provide adequate information support for the process of interaction between government and society on a widely accessible, continuous and timely basis" (Ustinova & Khayrullina, 2015).

3. A slightly different form of communication is making reports, which provide an analysis of the work done, recognition of errors, and identification of paths for further action, as well as all kinds of preventive measures and their results. Feedback is of great importance when using this form, reflecting on the performance of subjects, their actions,

effort, and consequent results (Chumikov & Bocharov, 2009).

4. Cultural and leisure communications during various holidays – during City Day, Harvest Day, and Cossacks Day for example, almost all authorities are involved. As a result, each institution that participates in any way during an event, should direct its efforts to creating a favorable image of its structure.

2.2. Communication Within the Concept of Information and Communication Technologies

Modern information and communication technologies incorporate various methods of creating, fixing, processing, and disseminating information. The category of technology is acquiring a dominant, system-forming significance in the present stage of social development. If in previous eras, technology was considered as a simple set of recipes and thought to be secondary to culture, in recent decades it has been recognized that technological improvement is the basis for the development of modern technogenic civilization, where radically new forms of human culture are associated with the birth of fundamentally new technologies. In connection to this, A. I. Rakitov notes: "... technology in the usual ... understanding is a set of various operations and skills that are implemented in a fixed sequence in the appropriate space-time intervals and based on a well-defined technique to achieve the chosen goals." During

the development of society, "technology is included in the system of social relations and activity structures ... technology becomes a factor in various social modifications and transformations, affecting various social structures and subsystems of society" (Rakitov, 1991).

In contrast to other technologies that are implemented exclusively in the field of material production and subject activity, and only indirectly affecting spiritual activity, modern information and communication technologies are a means that penetrates mainly into the sphere of intellectual labor. Modern information and communication technologies are a fundamentally different type of technology, different from all previous ones, possessing "cultural and gnoseogenic functions in addition to the sociogenic function inherent in all of them".

The sociogenic function, which is inherent in all technologies and acts as a factor in various social modifications and transformations, finds expression in the manifestation of culturogenic and gnoseogenic functions, in the case of information and communication technologies (ICT).

1. The culturogenic function of modern ICT. When implementing this function, modern information and communication technologies penetrate "... into all the mechanisms of mass communication, education, upbringing, training, personality formation influences, lifestyle, and systems of interpersonal communication" (Udovik, 2011).

2. The gnoseogenic function of modern ICTs is "... the set of procedures and operations carried out using modern computers and information networks that affect cognition and contribute to the growth of new knowledge ...". Modern ICTs generate intelligent technology, which includes artifacts, software products and knowledge systems that ensure the birth of a fundamentally new phenomenon in the history of technological civilization. This phenomenon exists due to the fact that it is possible to produce, transform, and carry out super-high-speed transmission and actualization of information not only with the help of the human brain and means of communication, but also with the help of completely new technical devices embodying the idea of artificial intelligence.

Consequently, the key vector in the development of modern information and communication technologies is not only to reduce the number of operations performed to collect and process information, but to radically change the entire system of spiritual and practical activity and cultural creativity.

2.3. Communication in the Digital Economy Concept

Today, Software Defined Networking and Network Functions Virtualization, automates the provision of services in virtual and physical segments, becoming the basis for the construction of a new generation of Internet. The explosive

growth in traffic caused by the proliferation of Internet of Things applications and services, video streaming, and corporate "cloud" environments can provide a transition to M2M digital platforms and communication technologies, machine-to-machine communication systems, or "physical object - physical object" (based on analytics, things themselves make decisions or give commands to other things), in turn allowing the creation of intelligent cities and smart factories in the future.

Thus, within the framework of a comparative analysis of communications in the concepts of social and communication technologies, information and communication technologies and the concept of the digital economy, the disadvantages of the analyzed approaches, are highlighted as follows:

- one-sidedness in understanding the essence and purpose of communication;

- the priority of certain factors in considering communication to the detriment of a systematic approach. So, it is the systematic approach, according to the authors, that makes it possible to comprehensively study the investment potential of information and communication technologies from the standpoint of increasing the competitiveness of an enterprise. Resource and functional criteria are used for assessing the information and communication potential of an enterprise, in order to determine the amount of possible fundraising.

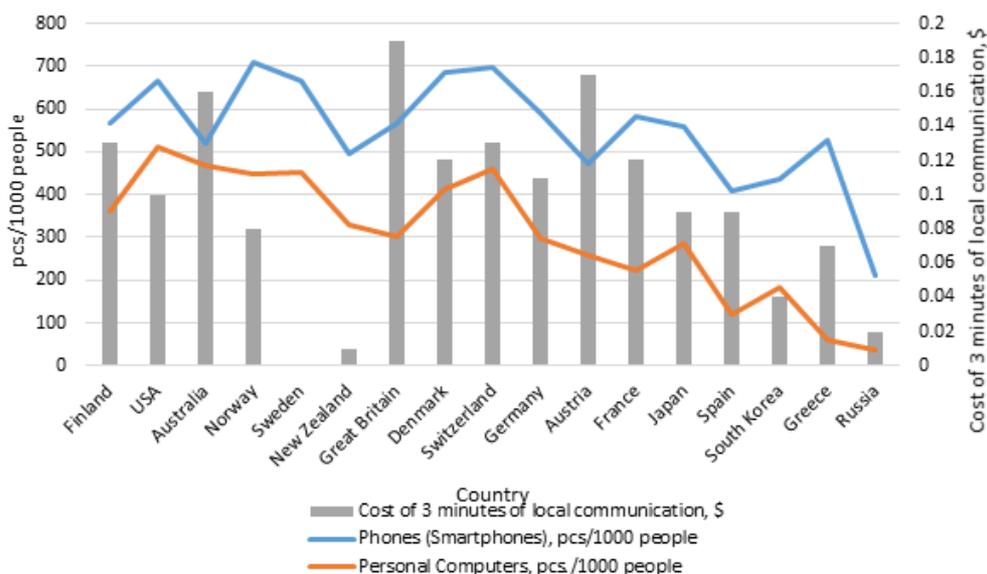
2.4. Investment Market in Information and Communication Technologies

The amount of investment in ICT is high in almost all industrialized countries. The largest investments in this sector are typical for the USA, Japan, and Western Europe. An important feature of the ICT sector is their investment attractiveness, due to the high return on investment and growth prospects.

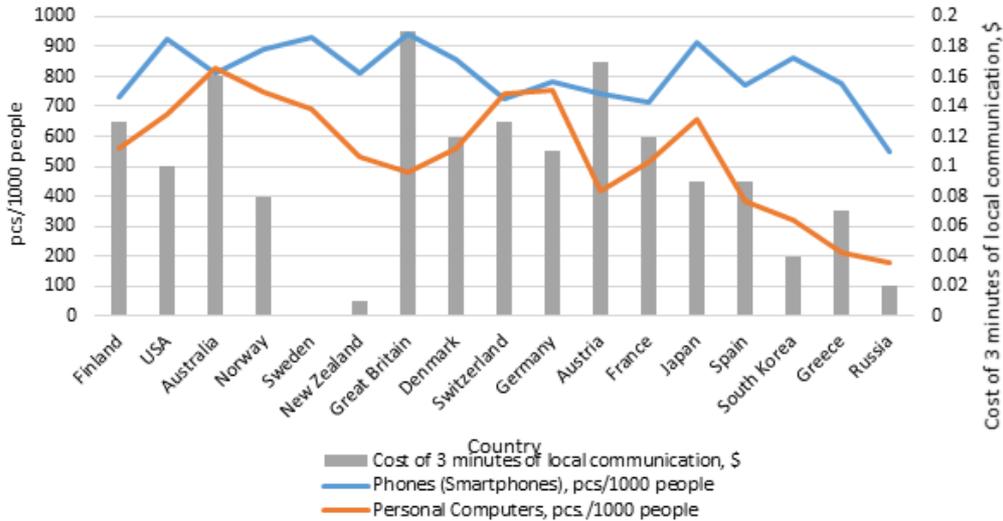
ICT creation sectors in developed countries have a strong potential for employment of the population. In the United States alone, the number of people employed in the production of goods and services in the field of information technology was 3.9 million people in 2016, and expected to increase to 4.1 million people by 2021.

A specific feature of the current stage of the country's technological development is a noticeable increase in the cost of mobile communications for subscribers, coupled with a 20 percent increase in the number of high-tech mobile devices in the hands of mobile technology users. Similar growth dynamics are observed in relation to the number of personal computers per 1000 people.

The data presented show that the predicted downwards trend for the twenty-hundreds regarding the production and consumption of personal computers, due to a growing demand for smartphones and significant expansion of their functionality, is not yet confirmed. Moreover, this process has not been affected by a growth in the cost of mobile communications noted in the graphs (Figure 2-3).



Source: Compiled by the authors based on data from Whale (2005).



Source: Compiled by the authors based on data from the International Telecommunications Union (2020).

In particular, in a number of technologically developed countries, in both Asian (Japan, South Korea) and European regions (Spain, Austria), the dynamics of a parallel increase in the absolute number of both mobile devices and personal computers over the past 15 years is clear. In relation to Russia, the noted dynamic is more prominent: an increase in the number of mobile devices per 1000 people generally corresponds to the growth dynamics of personal computers per 1000 people.

Of the analyzed states, Switzerland and Germany have the most coinciding trends in the quantitative indicators of mobile and personal devices.

These trends are not least due to the development of technologies that make it possible to equalize the cost of

mobile devices and personal computers.

According to a review by the Russian Association of Venture Investments (Market Review. Direct and venture capital investments in Russia, 2018) at the end of 2018, the information and communication technology (ICT) sector remained the focus of attention of venture investors. About 70% of venture capital investments - both in volume and in number - fell on the ICT sector. When analyzing the trend dynamics, taking into account the industry preferences of new players does not yet allow us to talk about a significant change in the situation; investors are in no hurry to increase their presence in the market of real technologies which is more resource-intensive, with a long investment cycle.

It is advisable to use a discrete

financing method as the main method for selecting venture financing facilities. This method allows for the cost of financial flows over time to be taken into account, as well as the strategic value of the project, also incorporating the ability of the investor to take an active part in the management of the company during the implementation of the project, and to quickly respond to a number of negative changes, minimizing losses.

Analysis of the available research on the volume of the investment market in information and communication technologies has showed that these studies mainly focus on the resource aspects of assessing the effectiveness of investment in ICT and do not practically affect the functional potential of using available technologies.

3. MATERIALS AND METHODS

Factor Analysis Method

To determine the effectiveness of investing resources in information and communication technologies (ICT), the study used a factor analysis method, allowing determination of the influence that various factors have on the effective indicator. The choice of this method is due to the fact that factor analysis within a systematic approach framework makes it possible to comprehensively assess the dynamics of the effective indicator and establish its intermediate values. It also allows for a comparison of the obtained values of the factor signs.

Supplementing this method using the point-rating approach and comparative coefficient analysis allows for an interpretation and substantiation of the findings with a high degree of objectivity.

Information and communication resources (ICR) were used as such factors. These resources include the following elements: informational, temporary, material, energy, and labor.

It is difficult to determine a quantitative indicator of the effectiveness of the use of these resources in the process of investing in ICT. In practice, the process of organizing investments is traditionally influenced by the following processes:

- 1) uneven provision of resources;
- 2) their non-optimal use.

Hypothesis. The authors test the hypothesis that the discrepancy between the functional and resource criteria for assessing the investment potential of a territory is due to the type of regional development.

The availability of resources is a necessary but insufficient condition for the effectiveness of investing in ICT.

The information and communication resources (ICRs) of an organization acquire value only upon receipt of a consumer assessment, that is, with their full participation in the functioning of the information and communication system (Khromov, 2006).

To conduct factor analysis, it is necessary to derive a formula that

determines the influence of various factors (information and communication resources (ICR) and information and communication factors (ICF)) on the effective indicator (P - the information and communication potential of the enterprise):

$$P_i = R_i - F_i \quad (1)$$

where: R_i is the enterprise' resources as an element of the information and communication system;

F_i is the information and communication factors, as a component of the information and communication resources of the organization, which is partially or fully involved in the system, bringing a result.

P_i is the information and

communication potential of the i -th factor of the enterprise.

The following options for the effective indicator are possible:

- $P_i > 0$ - the organization has stocks of i - resource;
- $P_i = 0$ - the optimal state of the i -resource and i - factor;
- $P_i < 0$ - investments in the i -th resource are necessary.

Therefore, with an ideal enterprise informatization system, the sum of all factors strives for the sum of all resources, characterizing the maximum efficiency of their use:

$$\sum_{i=1}^m F_i \Rightarrow \sum_{i=1}^m R_i \quad (2)$$

Figure 4 clearly demonstrates the interpretation of the theoretical model for managing the efficiency of investment in ICT.

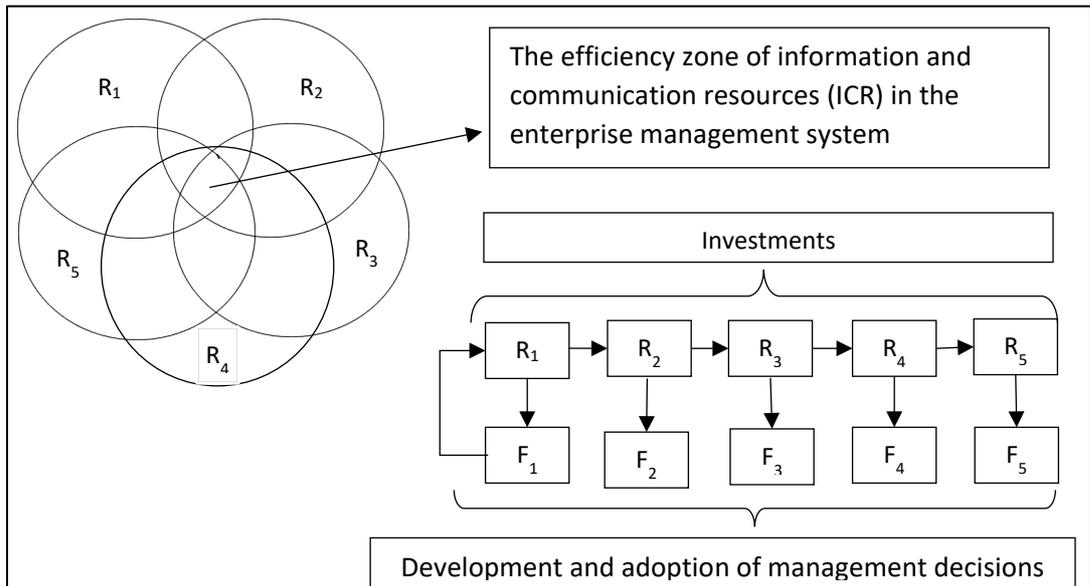


Figure 4. ICT Investment Performance Management Model

Source: compiled by the authors, based on Khromov (2006).

If ideal conditions are observed, then the sum of all factors (F_i) should tend to the sum of all resources (R_i). Graphically, such a zone of effectiveness is represented as a circle (Figure 4).

This management model of ICT investment performance allows visualization of the intermediate stages, describing them quantitatively, measuring and controlling them. A feedback mechanism is also implemented, taking into account the effectiveness of the implementation of factors, and information and communication resources, after which the most optimal investment management decision is made.

4. RESULTS

The information and communication resources (ICR) of an organization (R_i) consist of information, time, material, energy, and labor resources. The effectiveness of their use when investing in information and communication technologies (ICT) is difficult to determine. Information and communication factors (F_i) are a component of the ICR that is partially or fully involved, yielding results.

Traditionally, the effectiveness of investment in ICT is influenced by two situations: uneven provision of resources, and their suboptimal use.

Table 1 shows the functional (F) and resource (R) criteria that ensure

the fulfillment of the given equation in the organizations of the business sector of the Kaluga region.

The Kaluga Region (Russia) borders on the Moscow Region. The growth of key indicators for the development of the regional economy are due to the constant additional involvement of resources in production and sales processes. New factories with a high proportion of automation, producing high-tech products, have come to the Kaluga region. Since 2006, 114 new enterprises have been opened in the Kaluga Region (Ministry of Economic Development of the Kaluga Region, 2020).

In his work, Kostin (2012) investigated the mechanisms of attracting investment to the region, since investors have higher requirements for the investment climate of the region; this incorporates the ability of regional enterprises to fully use the available resources and their functional potential.

The criteria were assessed using a 10-point scale. The maximum score (10 points) is assigned to a criterion that is fully met by the enterprises of the region. After summing up the scores by functional criteria, they were compared with each other (using the formula $P_i = R_i - F_i$) in order to determine the information and communication potential of the i -th factor (P_i) (Table 1, Figure 5).

Table 1 The Ratio of Functional and Resource Criteria for Determining the Information and Communication Potential of Enterprises in The Entrepreneurial Sector of the Kaluga Region

Resource criteria (R _i)		Comparison	Functional criteria (F _i)	
Criterion name	Score in points (on a 10-point scale)		Criterion name	Score in points (on a 10-point scale)
(R ₁) Material resources (availability of an up-to-date hardware and software complex necessary for the successful implementation of ICT)	7,2	<	(F ₁) Chronological characteristics of the information and communication process (ICP) (data transfer rate, memory capacity for storing information, etc.)	8,1
(R ₂) Energy resources (energy requirements for the implementation of the information and communication process (ICP) for ICT)	8,4	>	(F ₂) The degree of stability of the energy-information infrastructure of the enterprise in relation to internal and external factors of volatility	7,9
(R ₃) Labor resources (quantitative and qualitative composition of employees responsible for the implementation of ICT)	5,4	<	(F ₃) Personnel characteristics demonstrating the degree and quality of information technology training	7,8
(R ₄) Time resources (the amount of time required to implement the ICP for a given ICT)	5,2	<	(F ₄) Optimality characteristics of the time parameters for the implementation of ICP, and the quality of communication interaction	7,4
(R ₅) Information resources (a set of competencies demanded in the process of ICT implementation)	6,7	>	(F ₅) Staff readiness to adequately perceive and display the results of ICT implementation (correctness of speech or image recognition, quality of generated graphic information; document reliability, etc.)	6,2
Total	32,9			37,4
Effective indicator P _i = R _i - F _i	P _i = 32,9 - 37,4 = - 4,5 < 0			

Source: Compiled by the authors based on data from the Ministry of Economic Development of the Kaluga Region (2020).

It follows from Table 1 that the functional criteria of enterprises in the entrepreneurial sector exceed the resource criteria by 4.5 points. This means that the resources owned by the enterprise (material, energy, labor, time, and information) are generally not used sufficiently in the production process, and the functional criteria of these resources (e.g. the quality of the information and communication infrastructure, the level of training of personnel, the implementation time for information and communication processes, the quality of graphic information, and the reliability of documents) are not fully met.

The analysis carried out shows the spread between the resource and

functional criteria is more than 13% in favor of the latter criterion.

It is graphically shown that the greatest discrepancy is observed between the resource criterion (R₃) “Labor resources” (5.4 points) and the functional criterion (F₃) “Personnel characteristics showing the degree and quality of information technology training” (7.8 points). The low indicator of the resource criterion (R₃), which is shown by the enterprises of the Kaluga region, is explained by the fact that the tasks set for the company's personnel do not allow for use of the existing potential for high-quality training of employees with a high degree of efficiency.

Thus, an excessive level of

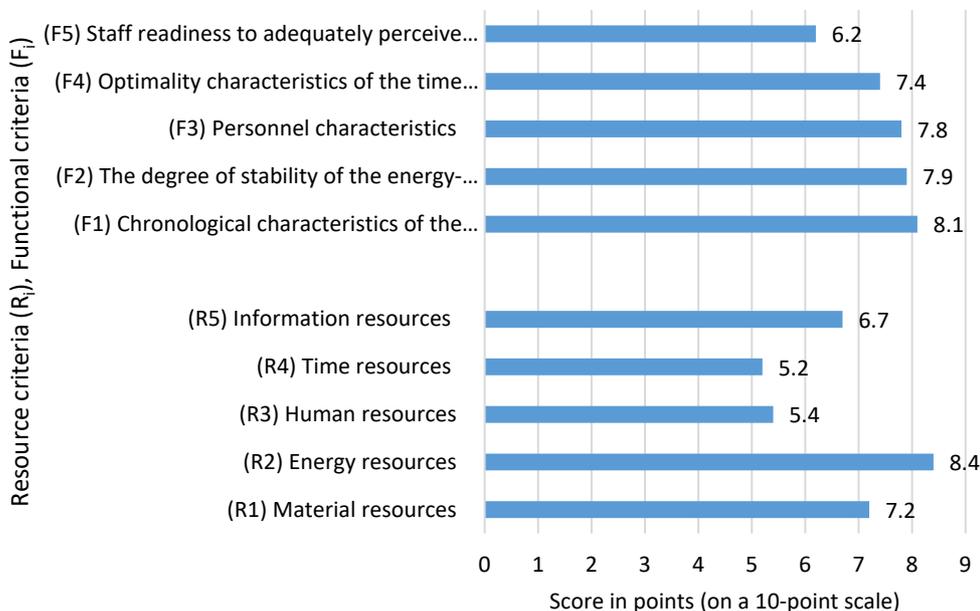


Figure 5. The ratio of functional and resource criteria for assessing enterprises in the entrepreneurial sector of the Kaluga region

Source: Compiled by the authors

professional training of employees of different levels is stated by the enterprises of the region. The Kaluga Region is characterized by extensive development in a region with high resource potential, for which there is an orientation towards increasing the resources involved in production and marketing processes, rather than increasing their levels of efficiency.

It can be seen in Figure 5 and Table 1, that the effective indicator P_i shows a discrepancy between the functional and resource criteria to ensure the effectiveness of investment in ICT. Organizations of the business sector of the Kaluga region require additional investment according to the following criteria: material resources, labor resources, and time resources.

5. DISCUSSION

This study used a systematic approach, combining resource and functional criteria for assessing the availability and completeness of the tested resources in the organization. This approach allows one to partially overcome the disadvantages indicated in the literature review and to increase the level of objectivity of the results obtained, through the use of resource-functional criteria.

Such a systematic approach, based on a combination of resources and factors, makes it possible to form a mechanism for managing the effectiveness of investments in ICT and to make the best investment decision. It allows for estimation of the contribution of information resources to the

economic indicators of the enterprise, which can be obtained based on an analysis of the criteria characterizing the production situation. This approach allows for obtaining detailed accounting information that unambiguously characterizes both the participation of this type of resource in the main production process at the stages of the technological process, as well as the status of the considered ICTs as the company's main assets.

For quantitative and qualitative assessment of the effectiveness of possible options for the designed or available ICTs, it is necessary to determine the criteria for their effectiveness. At the same time, using methods for assessing the effectiveness of ICTs, it is necessary to identify intermediate stages in such a way that they can be described, measured, and controlled using quantitative indicators.

When assessing the information technology needs of enterprise management, in the course of deciding on the implementation of an ICT project, it is necessary to determine a system of performance indicators.

For example, Computerworld (Gartner: Finance goes to the cloud much faster than expected) uses quantitative and qualitative assessments to compare companies on the performance of their ICT technologies. In particular, the efficiency of the implemented IT solutions is linked to the volume of the cloud services used, which allows, with a high degree of dispersion of departments and individual

employees, to optimize the resource and chronological potential of the projects being implemented.

Research from Gartner shows that small and mid-sized companies are adopting cloud technologies faster than larger enterprises. In the next three years, a transition to the cloud is planned for 44.6% of small organizations, 37.7% of medium-sized, and 40.4% of large organizations.

6. CONCLUSIONS

The aim of the study was to substantiate the applicability of the combined approach for managing the efficiency of investment in the information and communication technologies of an enterprise, containing a set of resource and functional evaluation criteria. Interest in the problem under discussion was generated due to the following factors. Based on the results of the analysis of the crisis phenomena caused by the COVID-19 pandemic, it was revealed that the rate of the business community to reduce investments in the ICT sector has not justified itself. On the contrary, the current situation indicates that only those companies pursuing a well-thought-out investment policy in the field of high technologies have viable prospects. Therefore, companies require a tool which allows them to determine the investment potential of an enterprise by comparing available resources and factors (degree of their use, completeness of development). The hypothesis that such a tool can be the

resource-functional approach, using a point-rating assessment and factor analysis, was tested.

The model for managing the efficiency of investment in ICT proposed in the study contains a set of resource and functional evaluation criteria. Using a factor analysis method, involving a combination of functional and resource assessment criteria, forms an effective indicator of information and communication potential which could be calculated in this study, using example enterprises from the entrepreneurial sector of the Kaluga region (Russia).

Based on the analysis of empirical data obtained from employees of the IT sector of 46 companies, a discrepancy between resource and functional evaluation criteria that ensures the effectiveness of investment in ICT, was revealed. The comparison was made based on data collected using a 10-point scale (for each criterion). The functional criteria of enterprises exceed the resource criteria by 4.5 points. This means that the resources owned by the enterprise (material, energy, labor, time, and information) are generally not used sufficiently in the production process and that the functional criteria of these resources (e.g. the quality of the information and communication infrastructure, the level of training of personnel, the implementation time of the information and communication processes, the quality of graphic information, and the reliability of documents) are not fully met.

In conclusion, this discrepancy lies in the prevalence of indicators of

the resource criterion over the functional one. In particular, a discrepancy was revealed between the resource criterion "Labor resources" and the functional criterion "Personnel characteristics, showing the degree and quality of information and technology training." Thus, an excessive level of professional training of employees of different levels at the enterprises in this territory is stated. This is due to the specifics of the extensive type of regional development of the Kaluga region, characterized by the predominance of investments in the resource potential, and not in increasing the level of efficiency in the use of existing technologies.

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