INSTITUTO POLITÉCNICO DE BRAGANÇA
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ICT and Big data Adoption in Small and Medium Enterprises (SMEs): Regions of Alto Trás-os-Montes, Castela e Leão and Krasnodar region

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Abstract

One of the components of the success of modern economic systems of any level and scale is the use of the latest ICT. The use of technology allows to increase the efficiency of the production process and take the business to a completely new level.

In this research, it is intended to assess the state of information and communication technologies (ICT) in small and medium-sized enterprises, the possibility of using Big data technologies for analyzing and making forecasts to improve economic performance.

The research of the use of ICT were carried out on the example of small and medium enterprises (SME) in rural areas in three countries: Russia, Spain and Portugal. The goals of the work are to conduct a comparative description of the selected areas, to determine the level of the current state of ICT, to bring proposals for raising this level. The main conclusion is that, although the objects of study are at different levels of economic development, they have similar experimental data, and the proposed improvement proposals may be useful for each of them.

To test it and answer to the goals of the research, statistical data will be collected for 2016-2018 on the use of ICT in three regions: Alto Trás-os-Montes, Castela e Leão and Krasnodar region.

Keywords: ICT, Big data, SME, Data Mining, Making decisions

Аннотация

Одной из составляющих успеха современных экономических систем любого уровня и масштаба является использование новейших ИКТ. Использование технологий позволяет повысить эффективность производственного процесса и вывести бизнес на совершенно новый уровень.

В данном исследовании предполагается оценить состояние информационных и коммуникационных технологий (ИКТ) на малых и средних предприятиях, возможность использования технологий больших данных для анализа и составления прогнозов для улучшения экономических показателей.

Исследования по использованию ИКТ проводились на примере малых и средних предприятий (МСП) в сельской местности трех стран: России, Испании и Португалии. Цели работы состоят в том, чтобы провести сравнительное описание выбранных областей, определить уровень текущего состояния ИКТ, внести предложения по повышению этого уровня. Основной вывод заключается в том, что, хотя объекты исследования находятся на разном уровне экономического развития, они имеют сходные экспериментальные данные, и предлагаемые предложения по улучшению могут быть полезны для каждого из них.

Чтобы проверить это и ответить на цели исследования, будут собраны статистические данные за 2016-2018 годы об использовании ИКТ в трех регионах: Альто-Траш-ош-Монтеш, Каштела-э-Леао и Краснодарский край.

Ключевые слова: ИКТ, Большие Данные, МСП, Интеллектуальный Анализ Данных, Принятие Решений.

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Abbreviations and/or Acronyms

ACS – Automated Control System

ADSL – Asymmetric Digital Subscriber Line

BI – Business Intelligence

BSC – Balanced Score Card

CAGR – Compound annual growth rate

CRM – Customer Relationship Management

DBMS – Database Management System

DDL – Data definition language

DESI – Digital Economy and Society Index

DM – Data Mining

DSL – Digital Subscriber Line

EMC – Estate Management Company

ERP – Enterprise Resource Planning

ETL – Extract, Transform, Load

EU – European Union

GB – Gigabyte

GDP – Gross Domestic Product

GPL – General Public License

GPS – Global Positioning System

GRP – Gross Rating Point

IBM – International Business Machines Corporation

ICT – Information and communications technology

IDC – International Data Corporation

IT – Information Technology

ITU – International Telecommunication Union

NoSQL – Not only SQL

OECD – Organization for Economic Cooperation and Development

OLAP – Online Analytical Processing

OS – Operating System

PC – Personal Computer

RDBMS – Relational Database Management System

RFID – Radio Frequency Identification

SaaS – Software as a service

SCM – Supply Chain Management

SDSL – Symmetric Digital Subscriber Line

SME – Small and medium-sized enterprises

SPSS – Statistical Package for the Social Sciences

SQL – Structured Query Language

SSIS – SQL Server Integration Services

UI – User Interface

XML – eXtensible Markup Language

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Chapter 1 Introduction

1.1. Context and motivation

By providing millions of jobs, the institute of small and medium-sized enterprises is the main means of sustainable industrial and social diversification of society, thus acting as one of the main engines of economic development in most countries (Balocco, Mogre, & Toletti, 2009). However, phenomena such as globalization, the internationalization of national markets, the global economic crisis, financial market volatility, reduced investment, rapidly changing consumer demand, put increasing pressure on SMEs, encouraging them to look for ways to survive and develop in a modern business environment. And one of the ways to improve the competitiveness of enterprises is the use of information and communication technologies. Access to ICT improves business efficiency and the global economy as a whole (Matthews, 2017).

This dissertation is devoted to assessing the level of ICT in three rural regions from different countries: Alto Trás-os-Montes (Portugal), Castela e Leão (Spain) and Krasnodar region (Russia).

This topic has been chosen because it is interesting to assess the three countries with different levels of economic development and identify key points and conclusions that could improve the found indicators of implemented ICTs.

The introduction of ICT, Big data technologies and Data Mining will allow small and medium-sized enterprises to reach a new level of development and optimize business processes. Using the explored data, it will be possible to adequately evaluate the condition of companies and their willingness to introduce new technologies, study

current trends and requirements for SMEs and identify risks, advantages and problems (Del Vecchio, Di Minin, Petruzzelli, Panniello, & Pirri, 2018).

1.2. Main objectives

The aim of the thesis is to analyze the capabilities of Big data technologies and level of ICT implementation in modern SMEs. In accordance with the set aim the following tasks of the thesis:

- Examine ICT, Big data technology and Data Mining.
- Establish criteria for comparison.
- Analyze and compare the current state of ICT in small and medium-sized enterprises.
- Based on the results of the analysis, draw conclusions, highlight strengths and weaknesses, make suggestions for improving ICT use and present the opportunities and risks of Big data for SMEs.

1.3. Methodology

To collect data for Portuguese and Spanish regions we used the results of the COMPETIC project[1] (competic-poctep.com) (Poctep, 2014), that made 263 surveys in the Spanish region of Castela e Leão (Leão, Zamora, Salamanca, Valladolid, Ávila) and 170 in the Portuguese regions of Alto Tâmega and Terra de Trás-os-Montes.

Field work was conducted from 24 September to 16 November 2018. Sample design: random sample by area, type of company and sector. Sampling error in Portugal: ± 7.52% for global data, 95.5% for a confidence level. In Spain, the sample size was 263 surveys. Sampling error in Spain: ± 6.04% for global data, 95.5% for a confidence level.

The data from Krasnodar region were collected from the site of the Russian Federal State Statistics Service (Rosstat, Information society, 2019), from the statistical

[1] COMPETIC Project - Support to entrepreneurs, self-employed and micro-enterprises in rural areas to create and develop their businesses taking advantage of ICT opportunities (operation 0381_COMPETIC_2_E).

compendium of the study «Indicators of the digital economy: 2018» (Abdrakhmanova, Vishnevskiy, & Volkova, 2018) and from practical guide «Information and communication technologies of the South of Russia» (Vysokov, 2015). The indicators characterizing research and development in the field of ICT, personnel of the digital economy, the activities of the ICT, content and media sectors, the development of telecommunications were reviewed. Statistical data reflecting the demand for digital technologies in the business sector and the social sphere were used. Data from scientific and practical manual "Information and communication technologies of the South of Russia" were also reviewed. Materials were taken from the Ministry of Communications and Mass Media, Rosstat, the Ministry of Education and Science of Russia, the Ministry of Culture of Russia, the Bank of Russia, OECD, Eurostat, ITU, the United Nations Department for Economic and Social Development, the World Economic Forum.

From the beginning, it is possible to conduct a comparative analysis and identify categories for comparison:

- Is there Internet access (type of access, speed, etc.)?
- Are cloud storage used?
- Is there a web page and its functionality?
- ICT use goals.
- Were there any plans to invest in ICT in the future?
- Are there any management applications?
- Are open source applications used?
- What are the difficulties of ICT implementation?
- How is security ensured?
- The benefits of ICT according to companies.

The next step is the comparison of the results between selected countries and assesses the level of ICT. In the course of this analysis, we determine readiness for the introduction of new technologies and ways to improve the economic situation of SMEs when introducing Big data. Based on the obtained results, we draw conclusions and recommendations for increasing competitive advantage for SMEs.

1.4. Structure of the work

The first chapter describes the context and relevance of this work, the chosen methodology and, in fact, the structure itself.

In the second chapter, we describe the basic concepts of SMEs and ICT, identify risks, benefits and trends. We also look at Big data technologies, analytics, and the prospects and risks of using them in SMEs.

In the third chapter, we will consider ICT in three countries, conduct a comparative description of selected categories, summarize some of the results and suggest ways to increase ICT levels and embed Big data.

In the chapter conclusions and future works we describe the conclusions, results of the research, which was made in the previous chapter. And there are some thoughts according to the future works.

Chapter 2 Review of Big data technologies and ICT in small and medium-sized enterprises

2.1. ICT and SMEs

2.1.1. Basic terms and essence of the ICT sector

First of all, should be identify the place of the concept “information” in the economy. Economic information is a set of information about the intended socio-economic processes to manage these processes and groups of people in the production and non-production spheres. In the modern dictionary of foreign words, technology is defined as a combination of methods and processes used in any business, the production of something, as well as a scientific description of these methods (Bessonov, 2011). The meaning and purpose of any technology is to optimize and, on this basis, put in a given structural and procedural framework a widely understood manufacturing process. The optimization here can be understood as an organization of the production process that allows you to achieve the maximum result with the specified resources or use the minimum amount of resources to obtain the desired result (Morgan, Colebourne, & Thomas, 2017).

Therefore, by information and communication technology (ICT) we will understand a process using a combination of methods and software and hardware to collect, process, store, transmit and present information in order to obtain new quality information,

reduce labor intensity and increase the efficiency of information resources utilization processes (Kokanov, 2016).

The central ICT tools are software, hardware devices operating on the basis of microprocessor, computing technology, modern means and systems of information broadcasting. These include: computers, information networks, input / output devices, tools and devices for manipulating textual, graphic, audiovisual information, archival storage of large amounts of information, software systems (programming languages, translators, compilers, operating systems, application packages, etc.), and modern means of communication and so on.

With the emergence of new data compression algorithms, the sound quality available for transmission over a computer network has improved significantly and began to approach the sound quality in conventional telephone networks. As a result, a relatively new ICT tool, Internet telephony, has become very active. With the help of special equipment and software through the Internet you can hold audio and video conferencing.

Information and communication technologies today play an extremely important role in ensuring information interaction between people, as well as in the systems for preparing and disseminating mass information. The most significant is the expansion of the Internet use. Other common ICT tools are available online, including e-mail, mailing lists, newsgroups, and chat. Special programs have been developed for real-time communication, which, after establishing a connection, transmit entered text from the keyboard, as well as sound, image, and any files. These programs allow you to organize the joint work of remote users with the program running on the local computer (Bifulco, Tregua, Amitrano, & & D'Auria, 2018).

The Internet, as one of the most important factors of globalization, determines the characteristic features of the development of the latter. If earlier in developed economies in conditions of tough competition, the one who better and more fully satisfied the needs of consumers won, today these two key parameters have added speed in all the variety of its definitions. This is the ability to show your ad faster and in a more prominent place than competitors, respond faster to a client's request, accept and process an order faster, deliver faster. Objective demand for specific, operational information gives rise to the proposal of mobile applications, which in the conditions of

growing number of purchases over the Internet from mobile devices can determine the success of an enterprise (Varnavsky, 2013).

Cloud technologies are being actively developed and introduced into the business. With the development of ICT, a large number of industrially functioning databases are being created, containing information on almost all of the company's activities. Technologies that provide mass users with interactive access to these information resources have been created. With the development of ICT, the convergence of household and computer equipment markets is increasing (Mihalic & Buhalis, 2018).

The main tool of ICT technology is a personal computer equipped with the necessary software (system and application nature, as well as tools). The system software primarily includes operating software. It provides interaction of all PC programs with equipment and PC users. This category also includes service and service software.

Applications include software, which is an information technology toolkit - working with texts, graphics, and tables. Universal business office software and ICT tools, such as word processors, presentation preparation, spreadsheets, graphic packages, organizers, databases, are widely used in business (Kramer, Jenkins, & & Katz, 2017).

2.1.2. History and evolution of ICT

ICT has come a long way to reach the current level of development. Some of the important stages of development are outlined below (Petzold, 2016).

Stage 1 (until the second part of 19th) was a “manual” information technology, the tools of which were: pen, inkwell, and book. Communications were implemented manually by forwarding letters, packages, mail through mail. The main goal of the technology is to present information in the required form.

The 2nd stage (since the end of the XIX century) is a “mechanical” technology, equipped with more advanced means of mail delivery, the tools of which were: writing machine, telephone, voice recorder. The main goal of the technology is to present information in the required form by more convenient means.

Stage 3 (40s – 60s. XX century) – "electric" technology, the tools of which were: mainframe computers and related software, electrical, typewriters, copiers, portable

voice recorders. The main goal of IT is beginning to move from the presentation of information to the formation of its content.

The 4th stage (since the 1970s.) is an "electronic" technology, the main tools of which are large computers and automated control systems (ACS) created on their basis and information retrieval systems equipped with a wide range of basic and specialized software systems.

The 5th stage (from the mid-80s) is a "computer" technology, the main tools of which are PCs and a wide range of standard software products for various purposes. At this stage, there is a process of personalization of the ACS, which is manifested in the creation of decision support systems by certain specialists. Such systems have built-in elements of analysis and artificial intelligence for different levels of control, are implemented on a PC and use telecommunications.

The 6th stage – "network technology" (sometimes it is considered part of the computer technology) is only being installed. Global and local computer networks are beginning to be widely tested in various fields. She is predicted in the near future rapid growth due to the popularity of its founder – the global computer network Internet.

2.1.3. Importance of ICT for SME

Medium and small businesses, as defined by the European Commission (2003), include enterprises with up to 250 employees and a maximum annual turnover of 50 million euros. The importance of small and medium-sized enterprises (SMEs) is indisputable for both developed and developing countries (Ongori, 2010).

The current state of affairs in the world shows that there is a close relationship between the development of ICT and economic welfare. The large-scale deployment of high-speed communication technologies and Internet access is a catalyst for the development of ICT projects, accelerates and scales technological progress, and ultimately ensures the growth of GDP in both individual regions and the country as a whole. Arguably that ICT has become a condition for successful business (Schubert, Fisher, & East, 2017).

However, today ICT use in managing business processes of small and medium-sized enterprises in developing countries is rather moderate (Chong, 2016).

The main purpose of the creation and implementation of new information technologies is to improve the quality and efficiency of organization management, increase productivity, reduce production costs and management activities, minimize risks, etc. Those new technologies that allow solving the greatest number of similar tasks in the complex are most in demand on the market. They bring tangible financial profits to the creators. However, it should be borne in mind that the creation and introduction of new technologies, products and innovations in the market require investments.

So in other words, the economic essence of innovations lies in the fact that they can bring a large income, but their costs and expenses are necessary for their creation and distribution. Needless to say, servers, cables and training are all expensive. However, there are some newer information technologies that are characterized by relatively small amounts of investment required and very high returns. A typical example of modern small and medium-sized businesses shows that the majority of successful enterprises are on average prepared to invest in their information technology infrastructure about 1/20 of their working capital, that is, about 5% of revenue per year (Balocco, Mogre, & Toletti, 2017).

The adoption of ICT by SMEs provides the ability to quickly access, evaluate, process and distribute large volumes of data and information about business infrastructure. Figure 1 -2 show the ICT trends and Top 10 SME-relevant ICT trends (Kotelnikov, 2018). Other obvious strengths of ICT are presented below:

- More customer attention.
- More responsive to market needs.
- Low bureaucracy.
- Informal working environment.
- Innovativeness.
- Quickly use opportunities.
- Flexibility.
- Well visible top management.
- Improving communication both within the organization and between organizations.
- More access to information and data processing.

It is obvious that the life of the SMEs is, on the one hand, a rich field of opportunities, and on the other hand a huge amount of difficulties and "traps". This situation is typical for countries with developed market economies, and for countries with economies in transition.

Here are some weaknesses and risks. For example, these are safety risks if proper measures are not followed. Also, do not forget about the reputational risks associated with closer interaction of customers in social networks. Improper use of communication technologies and information can lead to poor performance.

The key reason for the limited use of most new technologies by small and medium-sized businesses is the uncertainty of entrepreneurs in obtaining benefits, their commitment to outdated work organization principles, which, combined with limited resources and high risks in implementing software, impedes business development.

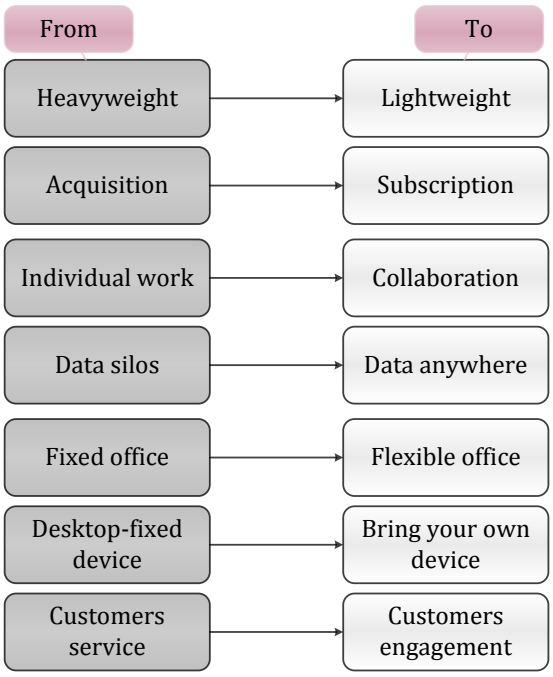

Figure 1: ICT trends: market shifts

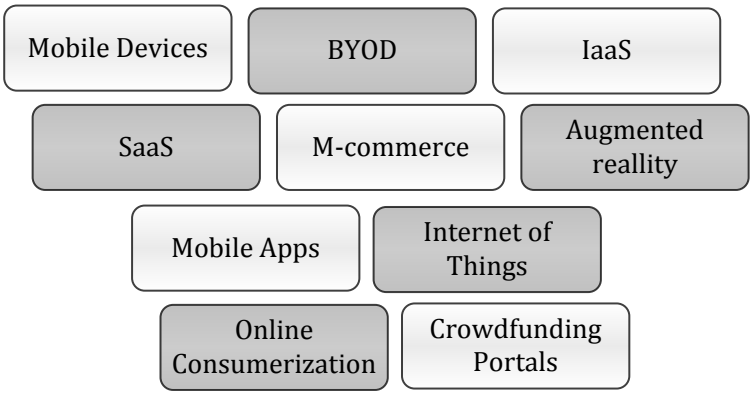

Figure 2: Top 10 SME-relevant ICT trends

2.2. Big data

2.2.1. History and evolution of Big data

The 1944 can be considered the starting point (according to one of the authors of Forbes), when the American librarian Fremont Rider published his work "The Scholar and the Future of the Research Library" (Rider, 1944). He noted that the collections of university libraries in America are doubling in size every 16 years and by 2040 the Yale University library will contain about 200 million books, which will need almost 10 kilometers of shelves to store.

According to the Association for Computing Machinery, the term Big data was first introduced in 1997 by Michael Cox and David Ellsworth at the 8th IEEE Visualization Conference. And in 1998, John R. Mashey used the term Big data in its current form at the USENIX conference (Devakunchari, 2014).

In the 2000s, it was clear that there was a huge need for innovation in regards to data and technologies for their processing. The root cause of the creation of the term "Big data" was dissatisfaction of the company that there were Big restrictions for working with data. The companies couldn't freely dispose and manipulate of data (Kune, Konugurthi, Agarwal, Chillarige, & Buyya, 2018).

In 2003, Google created MapReduce (application that allowed the firm to analyze information from thousands of servers in a short span of time). The program improved productivity and changed customary boundaries about what could be done with data.

Almost 10 years later, Big data has become a central principle of information technology and system. But what has prompted this growth and how will Big data change information technology?

Today, one of the fundamental technologies of "Big data" is Hadoop. It's an open-source framework software, the companies can create a file system with a team of programmers and solve individual and previously impossible tasks with the data.

By 2011, such large companies as Microsoft, Oracle, EMC and IBM became interested in Big data – they were the first to use Big data in their development strategies, and quite successfully.

The future of Big data is less about volume and velocity, and more about the value that the business can extract from it. Most companies have already understood the value of their data and have developed a strategy for using it (Moustakerski & Kim, 2015). And such enterprises will outperform their competitors financially. And the Economist Intelligence Report by Unit has already proven that (Unit, 2015). But the opportunities for growth and advancement Big data holds have yet to be fully realized.

In 2017, when Big data ceased to be something new and unknown, their importance not only did not diminish, but increased even more. Analysis of large amounts of data will be available not only for giant organizations, but also for small and medium-sized businesses. This approach is planned to be implemented using next components:

- Cloud storage as a cheaper alternative.
- Using Dark Data – all non-digitized information about the company that may serve as a reason for switching to a new format for storing information.
- Artificial Intelligence and Deep Learning – Machine Intelligence and minimal error probability.
- Blockchain – speeding up and simplifying numerous online transactions, including international ones.
- Self-service – are free sites where small and medium-sized businesses can independently process the data they have and analyze them.

2.2.2. Importance of Big data

The 21st century is undoubtedly an information explosion. The development of technology, the Internet and computers has led to the fact that the amount of information around us is growing exponentially. And therefore, the term Big data is on everyone's lips. But what is it? How and where is it applied? Is Big data technology an amazing breakthrough, or is it a marketer's fiction?

Today, the term Big data is known to one and all as something necessary for working with a huge amount of information. Big data has three main characteristics: Volume, Variety, and Velocity (McAfee & Brynjolfsson, 2018).

Volume characteristic refers to the size of data. Data is measured in the physical volume of the "document" that needs to be analysed.

Variety characteristic refers to the format of Big data – structured, semi-structured or unstructured. An example of unstructured data format is, a video file format, image files, standard MS Word documents. Also to note, relational database danagement system does not have the capacity to handle unstructured data formats. Therefore, all this unstructured data should be grouped and consolidated.

The velocity characteristic demonstrates the speed at which data is generated and the efficiency required to process all the data. The data does not stand in its development, but constantly grows, which is why it is necessary to quickly process them to get results.

However, sometimes, other dimensions of Big data have also been mentioned (Gandomi, 2015):

- Veracity (accuracy or plausibility of data) – represents the unreliability of some data sources.
- Viability or and complexity – the variation in the data flow rates. Since Big data is generated through multiple sources, it is necessary to connect, match, cleanse and convert this data.
- Value – data in the original form usually have a low value relative to its volume. But we can improve this characteristic by analyzing more data and make them a strategic asset.

All characteristics are intertwined with each other. The changing any one affects all other. For example, value, complexity and variability increase, but veracity declines. And it's important to remember that data volume is declining over time (Lee, 2017).

The development of Big data is recognized as one of the most important areas of future information technology. Now we will select the highlights of the impact of Big data, which can optimize the work not only in the large companies, but also in SMEs (Raguseo, 2018).

- Cost reduction – data analytics allows you to quickly and efficiently respond to problems, make better forecasts of supply and demand, increases the efficiency of routing with visualization.
- Improved customer service – Big data analytics can be used to analyze transactions online, detect fraudsters' actions and quickly notify clients of them. The ability to collect data from multiple sources can help support personnel understand the customer more quickly and solve their problems and thereby improve service.
- Improved product and service – Big data analytics allows you to improve products or services, as it gives you a complete understanding, for example, which product / service is best sold, what factors affect it, what the client lacks, and so on.
- Better pricing – Big data analysis allows firms to correctly estimate and set prices and provide individual coupons and loyalty programs for customers. Continuous analysis (for example, value for money) and comparison, for example, with products already sold, allow you to dynamically set prices.
- Fraud prevention – most relevant for the banking sector. Big data technologies and Machine Learning make it possible to calculate all possible risks and fraudsters and reduce them at the first suspicion. Security is achieved by using Big data in internal processes, without showing detailed information to clients.
- Personalized recommendations – analysis of data in any field allows you to know the client as much as possible, assess the relevance and necessity of a product or service at a given time in a given place, and thus offer a point solution to any problems.

The practice of working with Big data shows that data management and the scope of development causes some problems. Almost every company faces problems in

processing speed, data quality, visualization, exception handling, etc. (Khezrimotlagh, Zhu, D.Cook, & Toloo, 2019).

The main problems of technical and managerial tasks are described below:

- Data quality – for any goal, the quality of data is of great importance, because it determines the correctness of the decisions made. However, as already mentioned, data are collected from a wide range of sources and they are unstructured, so the quality of the data decreases.
- Data security – high probability of data loss and weak security leads to financial losses and loss of confidential information.
- Confidentiality – Big data is a key to better service and cost reduction. However, only one fifth of Internet users believe that the benefits of analyzing data from sensors or smart devices outweigh the confidentiality problems.
- Material costs – expensive equipment, the salary amount for qualified professionals, who can serve huge amounts of information, the need for regular equipment updates – all of this is a concern for managers.
- Data management – with a large number of results, it is very difficult to remain objective and to isolate from the total data flow only those that will have a real impact on the state of a phenomenon. Few companies are willing to allocate money to store all the information from several sources.
- Shortage of qualified scientists – unstructured data and the complexity of data processing led to the problem of a shortage of skilled workers. According to Bureau of Labor Statistics, the need for scientists, architects and analysts will grow by 23% through 2020 (Statistics, 2017).
- Data discrimination – with the growth of information, discrimination of people has also increased. We can already give a prime example of this: on the basis of personal data and an assessment of our creditworthiness, we decide who can take money from the bank and who can't.

2.2.3. Spheres and real commercial solutions

The active introduction of Big data technologies to the market and in modern life began just after they were used by world-famous companies with customers in almost every

part of the globe. These are social giants such as Facebook and Google, IBM, as well as financial structures like Master Card, VISA and Bank of America.

Gartner Survey for 2015 shows that more than 75% of companies are investing or are planning to invest in Big data in the next two years. These findings represent a significant increase from a similar survey done in 2012 which indicated that 58% of companies invested or were planning to invest in Big data within the next 2 years (Gartner, 2015).

As a rule, the primary goal of most organizations is to improve the quality of customer service, other popular goals are to reduce costs, more targeted marketing and improve the efficiency of existing processes. Figure 3 shows how Big data technologies are spread across fields of activity (Katal, 2017).

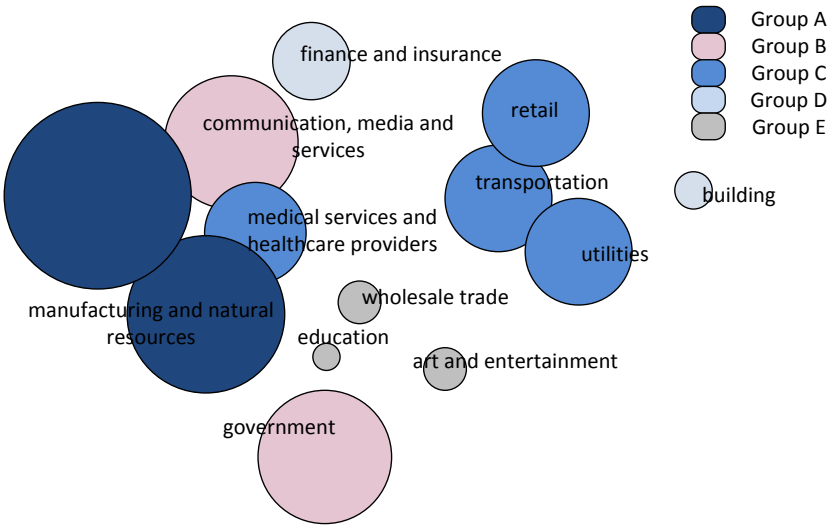

Figure 3: Distribution of Big data by fields of activity

Big data are already actively used in the areas of banking, education, government, transport, production. Some examples of the successful implementation are given below.

A well-known online platform for hosting, searching and short-term rental of private housing around the world is AirBnB. On the company's website, you will not only find

information about the owner of the living space that you want to rent, but also check if he is a friend of someone you know on Facebook.

User data is also analyzed by Netflix. The staffs of the service have developed an algorithm that allows forming high-quality recommendations of films. Moreover, the company used the accumulated information to create its own unique content, which made a worthy competition to the best cable TV products.

Procter&Gamble uses Big data to design new products and make up global marketing campaigns. P&G has created specialized offices in the Business Spheres where you can view information in real time. Thus, the management of the company had the opportunity to instantly test hypotheses and conduct experiments (Ivanov & Vampilova, 2018).

New technologies are also ideally suited for data collection in the agricultural sector. Farmers buy modern combine harvesters and see that they have many functions. For example, GPS navigation or landing sensors. With their help, the farmer begins to carefully monitor what is happening in his field. And then you can learn how to use new data collection features to increase productivity. You can collect information about irrigation and soil moisture to calculate the optimal irrigation regime or the required amount of fertilizer. Calculate the best route for vehicles and save fuel. Technologies compensate for the lack of workers in the agricultural sector. Big data is able to optimize the processes on the field, which previously required specialists.

2.2.4. Big data technologies

2.2.4.1. Databases

In this chapter, we look at information and communications technology and Big data technologies. First of all the information – it can be claimed anywhere at any time. Therefore, we are talking about distributed databases and data warehouses, search engines, technologies for searching for adjusted information.

In 2019 year any developer has lots of choices for the databases. There are, basically, two types of the database. We will now consider the most popular databases.

- NoSQL (examples): MongoDB, Redis, Casandra.

Oracle.

It's really famous among all developers. Oracle NoSQL Database handles Big data, provides access to the data through the node for the requested key, uses Java/C API to read and write data. Oracle Database 12c offers a wide range of features to help customers meet specific requirements in the areas of high availability, performance, security, Big data, compliance, data warehousing and manageability, both on-premises and on Oracle Cloud (Anand & Rao, 2017).

Oracle is available in four different editions: Enterprise, Standard, Standard Edition One, Express. Oracle provides Virtual Private Database, Data Guard for standby database, automatic memory storage and undoes management. Oracle database is secure and ensures that user data is not tampered with through prompt updates.

Cons of Oracle: takes up a lot of space, high price for small companies, require significant resources for installation.

MySQL

First of all, every enterprise can start out using the free community server and later upgrade to the commercial version. MySQL runs on Linux, Windows, OSX and FreeBSD and Solari. The open-source GPL license and community allows developers to modify the MySQL software to fit their own specific environments, and to use bank of tutorials and information to solve quandaries (Oracle, 2012).

MySQL supports large databases, up to 50 million rows or more in a table. A further advantage of the MySQL is support for partitioning and replication, as well as for Xpath and for stored procedures, triggers and views.

Cons of MySQL: support is available for the free version, no built-in support for XML or OLAP, it takes a lot of time and effort to create incremental backups.

Microsoft SQL Server

Microsoft SQL Server is the most widely used commercial DBMS. This DBMS provides high performance, generates scripts for data movement, and supports SQL language. Limited to Windows, but this is an advantage if your enterprise uses mostly Microsoft products (Buffington, 2016).

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Pros of Microsoft SQL Server: reduce temporary database problem, separate security privileges and maintain standby server.

Cons of Microsoft SQL Server: Integration Services issue to import files, ideal for only large organization, compatibility, difficult licensing process that's always changing.

2.2.4.2. Analytical platforms

The next step is analytic work. Speaking of SMEs, it is fair to say that a general practitioner can perform analytical work. ICT offers expert systems for this. The following are some analytics platforms for processing Big data.

Predictive analytics platforms are programs that provide an integrated environment for Machine Learning, Data Mining, text analysis and business intelligence. They are focused not only at analyzing entities, but also at managing solutions and optimizing them, which will help to choose a solution leading to the best results.

RapidMiner

RapidMiner is a free open-source environment for predictive analytics. The great advantage of RapidMiner is that you don't need to know programming to use it. This platform for analyzing Big data can work with Hadoop if you will use the RapidMiner Radoop paid extension (Naik & Samant, 2016).

RapidMiner is used for data preparation and Machine Learning. It offers a set of products for creating new Data Mining processes, integrates with internal databases and stores streaming data in a variety of databases.

Strengths of the product: several data management methods, interactive, shared information panels, the ability to filter data, their association and aggregation. It is also possible to build reports and initiated notifications.

IBM SPSS Modeler

IBM SPSS Modeler Platform is competitor of RapidMiner, because it is characterized by a low entry threshold for beginners.

Product features are automated modeling, geospatial analytics, support for open-source technologies (user can use R, Python, Spark, Hadoop to improve analytics). But this product has one Big drawback – the attributes that make SPSS easy to use are too limited for large-scale approaches to work with Big data technologies. In very bad cases, SPSS just "falls" from overload (Ayhan, Pesce, & Comitz, 2017).

Informatica Intelligent Data Platform

Informatica Intelligent Data Platform provides intelligent and management services that can work with most popular data and formats (web, social networks and so on).

The great advantage of this product is an approach for entering structured, semi-structured and unstructured data on a single semantic wave. Understanding between these data is possible using mapping, heuristics, and pattern matching (Dobre & Xhafa, 2014).

The main characteristics of the Informatica data analysis platform are a hybrid structure (allowing users to connect any application to any device), systematic and global data, optional software development skills and knowledge of any programming language for analyzing information.

The next stage is decision making. At SMEs, it becomes part of the work of each employee responsible for his or her area of work. ICT offers for this purpose decision-making tool, access to knowledge bases and repositories, knowledge systems.

Such technologies as Internet / Intranet technologies, fiber-optic and satellite communication systems, mobile systems, search systems, mobile agent systems, expert systems, flexible planning and risk management systems, high-performance computers, polling systems and preferences detection, of course, only contribute to the work, help to receive and send information from the place where users are located, first examine the client's capabilities and establish virtual contact with him, correct plans and respond to changes by the client.

2.2.4.3. Data integration

The importance of data integration should be emphasized. As data integration combines data from different inputs, it enables the user to drive more value from their data. This data must be understood in aggregate, rather than in isolation. Data integration is nothing more than a technique and technology for providing a unified and consistent view of enterprise-wide data. Data integration is the process of combining data from different sources into a unified view: starting from ingestion, to cleansing, mapping and transforming to a target sink, and finally making data more actionable and valuable to those accessing it. This is the main thing in working with Big data.

Features and capabilities are presented below:

- Improves unification of systems.
- Higher data quality over time.
- More effective collaboration.
- Saves time.
- Reduces errors.
- Delivers more valuable data.
- Data synchronization to ensure timely delivery of accurate data.

Data integration tools have improved over time, but there are still some challenges: data may be in different formats (if they were created in different systems); data may be missing, biased, corrupted, unavailable, or unusable. Sometimes problem is cost, lack of business purpose or inadequate testing.

When working with Big data, where multiple different systems are creating large volumes of data, we need powerful data integration tools.

Functions and capabilities of data integration tools:

- Ability to process unstructured data from social media, email, web pages, etc.
- Support for metadata.
- Deduplication and removal of incorrectly or improperly formatted data.
- Ability to process data from a wide variety of sources (mainframes, enterprise applications, spreadsheets).

The following suppliers have advanced offers supported by a solid outdated name. (Mukherjee & Kar, 2017).

Table 1: Data Integration Software Providers

	Informatica	**Oracle**	**SQL Server Integration Services**
Pros	Big data connectivity, Data Integration solutions, and Data Quality assurance solutions. Developing ETL mappings and workflows is a very intuitive process and requires minimal time and effort even for a beginner. Works with any multi-database. Good performance and easy to use. Purge obsolete code. UI-based ability to create data mapping. Easy to code and understand solutions in Informatica. Import from PowerCenter, copying text between Excel and a developer tool, editing maps for reading and writing logical data objects, requesting DDL Good technical support. Modularity, deployment and Licensing flexibility.	It supports all platforms, hardware and OSs with the same software. Ability to easily load slowly changing dimensions. Most of the functions are very straightforward, like the data model, mapping, package, and load plan. Ability to change the SQL when something is not performing correctly. Can integrate with more recent databases like Cassandra, Hadoop, and other more recent Big data databases. Flexibility, ease of customization, extensive features, ease of deployment, and the ability to access all type of different source system technologies. No need for extra hardware for transformation step. Is simple and easy to learn.	Well interacts with a large number of available libraries. It provides a reliable developer interface. It allows a developer to encapsulate complex scripts directly within an SSIS project or reuse scripts across projects. Logging can be configured to record only what is needed. There is an excellent logging replacement called BiXpress. Ability to be deployed into the cloud through Data Factory, and run completely as a software as a service in the cloud. The scope is not only to handle ETL challenges, but also allows to perform many other tasks, such as DBA activities, scripting, calling any .exe or scripts, etc.
Cons	Can be scalability issues (huge amounts of data ingestion will impact performance). Initial setup is not straightforward. Informatica Enterprise Data Integration unavailable for MacOS. The built-in planning tool has many constraints such as handling Unix/VB scripts etc.	The lack of a set of tools suitable for complete data processing and moving them to decision support repositories. Lack of integration with some other platforms. It is not intended to integrate real-time data. Difficult to maintain security setting.	SSIS memory usage can be quite high particularly when SSI and SQL server are on the same machine. SSIS is not available in any environment other than Microsoft Windows. SSIS does not work with any internal database engine other than Microsoft SQL Server. Need to write push down join & lookup SQL to the database yourself via stored procedures or use of the SQL Task to get very high performance. The change in the source of the metadata damages the entire ETL process, requiring manual re-opening of each module. The properties of the components are not well defined, which makes the learning curve more difficult.

2.2.5. Business Intelligence vs Data Mining vs Big data

It's no secret that not all information is equally useful. Sometimes for explaining some information we need to write a lot of text, but sometimes it's enough just to have diagram or table (Chen, Chiang, & Storey, 2018). For better understanding of Big data, Data Mining and Business Intelligence should be considered in parallel. It is clear that data from enterprises can be obtained in different forms; therefore, they must first be converted. The following are some processes that include in Data Mining: data integration, data cleaning, data transformation, pattern evaluation, data presentation (Lefebvre-Ulrikson, Costa, & Rigutti, 2016).

Thus, we can say, that Data Mining is a class of software for non-standard data analysis, that works only with structured data. And Big data is a technology stack and architectural principle that solves unstructured data problems. This may include the analysis of these data in the future. It is also possible to send structured data after Big data to Data Mining for data analysis. Alternatively, you can use specialized tools for Big data and not convert the data into a structured representation (as a result, we will get a similar analysis of Data Mining).

Table 2: Comparative characteristics between Business Intelligence, Data Mining and Big data

	Business Intelligence	**Data Mining**	**Big data**
Formal definitions	Term that includes the applications, tools and best practices for converting raw data into useful information and to make better decision for business	The process of exploring data and finding answers to issues you did not know you were looking for beforehand	Term that includes capture, process, and analyze the data, both structured and unstructured to improve customer outcomes
Tools	OLAP, Sisense, Data Warehousing, Tableau, Qlik Sense, Google Analytics	Rapid Miner, Weka, R, Knime	Hadoop, Spark, Hive, Polybase,bPresto, Cassandra, Plotly, Cloudera, Storm
Benefits	Improved data quality, reduced costs, increase revenues, faster reporting and analysis	Increase company revenue, quick fraud detection, predict future trends, helps in decision making	Better Decision making, cost savings, improves the service, forecasting, better sales insights, storage, mining, and analysis of data
Applied Fields	Social media, Healthcare, Gaming Industry, Food Industry	Healthcare, Market Basket Analysis, Education, Manufacturing Engineering, Fraud Detection	Banking sector, Entertainment and Social media, Healthcare, Retail and wholesale

Data Mining uses different types of tools and software for Big data to return specific results. In short, Big data is the asset and Data Mining is the manager of that is used to provide beneficial results. Business Intelligence most often refers to processes, tools, architectures, and technologies that transform data into effective intelligence and knowledge. BI tools present analytical findings in reports, summaries, dashboards, graphs, charts, and maps. Thus, users receive detailed information about the state of the business (Hatta, Miskon, & Ali, 2017).

2.3. The role of Big data and ICT for SMEs

Compared to large holdings, small and medium businesses have a number of features that play a positive role in the competitive environment (Abdrakhmanova, Gokhberg, & Kovaleva, 2015):

- Ability to quickly respond to customer requests.
- Ability to make a management decision in a short time and bring it to life.
- Ability to quickly and flexibly adapt to changes in the business environment.
- Immediate reaction to the risk of information leakage.

These prerogatives are most typical for firms engaged in serving customers in the restaurant and hotel business, tourism, services, trade (shops selling household appliances and tools, food, pharmaceutical goods), consulting (services in the field of finance and law) and various small productions (Azam, 2015).

The impact of information technology on small and medium business is embodied in solving a number of typical problems (Coleman, Göb, & Manco, 2018):

- Build customer base.
- Increase in sales.
- Increased business process coordination.
- Cost reduction.
- Business protection.

These problems can be solved by the CRM-systems, call-centers, automation of business processes (logistics, sales, accounting, finance), IT-outsourcing, IP-telephony, implementation of integrated information security systems.

Thus, the impact of information technology on business includes (OECD, 2004):

- Implementation of data processing tasks, if there is access to the source of information and information systems for its analysis.
- Availability of modern communication systems that ensure the interconnection and interaction of user workplaces for the operational broadcasting of information.
- Availability of open access to the global information space, the elimination of any obstacles to interaction in the business environment.
- Availability and continuous improvement of the system of electronic orders and sales.
- Full use of social networks.

Most often, when we start talking about Big data, we hear that "it is very expensive", "it will have to be implemented for a long time", "Big data is not needed in my business", etc. First of all, we must understand that the data is not a panacea. Your business can be successful without them, and it can fail with them. But if you look a little more globally, having a built system seriously increases your chances of success of your business.

So when should an SME go to Big data? There are four important criteria for company readiness: companies must be financially healthy, be innovative, visibly involved in online activities and have recent experience in the transition process.

Experts note that the Big data trend is becoming a obvious engine of the ICT industry. This is natural, because the amount of information stored worldwide is growing rapidly, by 40% annually (Corporation, 2015). 2010 can be considered as a certain milestone when the volume of "Big data" exceeded 1 Zettabyte mark (1 ZT is approximately equal to 1 billion TB). According to forecasts, by the beginning of the third decade, this figure will increase to 40 ZT (CNews, 2014). Few people doubt that analyzing the flow of unstructured data (namely, unstructured is considered the main feature of Big data) opens up huge business opportunities.

Today, working with Big data is a catalyst for cloud infrastructures. In many cases, databases should be processed "on the fly" until they are no longer relevant. Therefore, one of the most important types of Big data is "fast data". The main trend - from now on, Big data is becoming an integral part of all modern ICT systems.

Previously, the main goal of IT projects was to reduce costs, and even now, according to IDC surveys, about 30% of companies continue to consider IT only a way to improve profitability. However, an increasing number of companies are not interested in their survival strategy, but in their development strategy. Therefore, for them, IT is turning into a search for new opportunities for a breakthrough in the market. Moreover, according to IDC, in 2020, more than 60% of the components and components of the "Digital Universe" will be in developing countries (Corporation, 2015). At the same time, explosive growth of Big data analysis services and an annual investment growth of 20% are expected. The significance of social media today has gone beyond "pure" marketing and information gathering.

Chapter 3 Case study: Regions of Alto Trás-os-Montes, Castela e Leão and Krasnodar region

3.1. Description of the case study

The introduction of ICT is one of the main factors of economic growth. This important role of knowledge and information has a significant impact on more peripheral regions as they strive to become competitive participants in the global market. Although debates about the so-called "digital divide" between countries are numerous, much less attention is paid to inequality in access to ICT within the country. Although there are clear signs that these internal differences can lead to the continuing marginalization of people and regions "disconnected" from the global information networks that support the modern economy and social life, thereby causing strong inequality. Available data on the use and penetration of ICT is usually transmitted to central areas, whereas for more remote and peripheral regions there is no such information. In this context, this study is aimed at studying the introduction of ICT in self-employed microenterprises and entrepreneurs from the peripheral regions of Portugal, Spain and Russia: Regions of Alto Trás-os-Montes (figure 4), Castela e Leão (figure 5) and Krasnodar region (figure 6).

In the case of Spain, there are 109,449 companies (in 2018), with 98.3% having 10 or less employees. In this sense, the existence of companies with more than 10 employees is less than on a regional or national scale. However, the small size of companies is a characteristic that defines the Spanish business structure.

In Portugal, micro-enterprises accounted for almost 96% of SMEs. Micro, small and medium-sized enterprises (SMEs) in the non-financial sector accounted for 99.9% of the total business sector, and in 2010, their number exceeded 59 167 the one verified at the beginning of the period (1 083 901). Microenterprises, which accounted for nearly 96% of the number of SMEs throughout the series, were highlighted.

Krasnodar region is the fourth largest in the country in terms of the number of small and medium-sized businesses. By 2025, the share of SMEs in the Russian Federation should be 40 percent. In Kuban, according to the regional development strategy, this figure will reach 50 percent in 12 years (Region, 2018). In 2019, there are 276,742 micro-enterprises, 7,936 small enterprises and 599 medium-sized enterprises (Service, 2019).

3.2. Alto Trás-os-Montes region (Portugal)

About 3.6 million people live in the northern region of Portugal, representing almost 35% of the permanent population of Portugal, providing 39% of national exports and about 29% of the national economy's GDP. Administratively, northern Portugal consists of 86 cities and 1,426 villages. The region has good communication infrastructure and internationalization. Based on a network of qualified scientific and technological equipment, northern Portugal has all the prerequisites for rapid response and development. There is a decrease in population, especially in rural areas in the lands of Trás-os-Montes. A high aging index is noticed here, that is, a high percentage of the population over 65 years of age. Sparse population density and high dispersion is also marked.

There are 1,196,102 companies in Portugal, of which 405,518 are in the north. 12,297 (1.0% existing in the country and 1.6% of the northern part) were located in Alto Tâmega. There are 19,198 companies in Trás-os-Montes (1.6% of the country's territory and 4.7% of the Northern zone). Alto Tâmega and Trás-os-Montes are characterized by a high share of the agricultural sector, 42.5% and 54.5% respectively (Poctep, 2014).

Micro-enterprises account for about 96% of the total number of companies in the non-financial sector. In the northern part of Portugal, employment is mainly in the manufacturing industry (33.6%). Portugal ranked tenth in 2016 in the European

entrepreneurship ranking with 8.6 entrepreneurs for every 100 active people. 57 companies from Alto Tâmega and 113 from the lands of Trás-os-Montes participated in this study. 30 of them can be qualified as small and medium-sized companies.

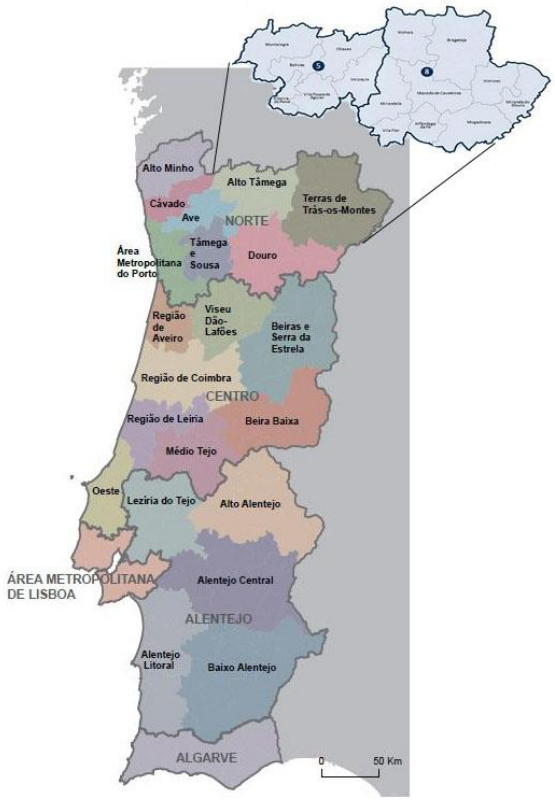

Figure 4: AltoTrás-os-Montes (Portugal)

In the field of communications, Portugal continues to improve its results (eighth place in the EU in 2018). The employment rate also increased. However, 18% of Portuguese handicraft products are not properly qualified compared to the EU average (10%). Despite progress in almost all indicators considered in this area, Portugal dropped to 21st place in the Digital Economy and Society Index (DESI, 2018) rating on the use of Internet services (19th place in the previous edition). Only the rate of use of online banking and purchases has increased. About 25% of Portuguese companies have a high or very high digital usage, compared with the EU average (21.5%), but over the past year in this area, the surveyed area fell from 9th to 11th place in standings. And on the other hand, the percentage of e-commerce business volume (16%) is almost two

percentage points below the EU average. By region, the use of different technologies is uneven: desktops, mobile devices, cloud computing, social networks, a website and open source software are more present in Alto Tâmega. The remaining technologies have more presence in the region of Trás-os-Montes.

3.3. Castela e Leão (Spain)

This study combines the following provinces in Spain: Leão, Zamora, Salamanca, Valladolid, Ávila. Together, the selected provinces cover 58.0% of the autonomous community and 68.5% of the population. The provinces are densely populated, 1,661,153 people lived in 2017. However, in recent years there has been a decrease in population, which affects not only the five selected areas, but also the autonomous community as a whole. Between 2013 and 2017, the selected population decreased in the region by 3.7%.

Figure 5: Castela e Leão (Spain)

In total, the objects of study consider 1257 municipalities. Zamora and Ávila have a large number of cities with less than 600 inhabitants. Valladolid and Leon are characterized by a smaller number of municipalities, but with more than 1,000 inhabitants. The highest percentage of the population is observed in Zamora (49.5%),

Valladolid (19.0%). The prevailing age in the province of Castilla y Leon is over 40 years old. Valladolid is a province with a higher percentage of the population under the age of 20 years (18.4%) and at the age of 21:40 (22.1%). In contrast, Zamora, where there is a higher proportion of the population over the age of 60 (35.7%).

Aging and population dispersion is a serious barrier to the advancement of the economy and entrepreneurship, mainly due to the lack of young people. In the economy of the analyzed areas, the agricultural sector and other services are of great weight. In Valladolid, the weight of industry (24.2%) is significantly higher than that found in other provinces. In Salamanca (31.8%) and Ávila (30.8%), "other services" are allocated. In Zamora, the agricultural sector has a remarkable weight compared to the rest of the territories. In Ávila (8.5%) and Zamora (9.0%), a significant proportion is construction. Trading plays an important role as well, especially in Ávila (21.7%).

The unemployment rate of the studied regions is lower than the national, but higher than that of other provinces of the Community. 5.8% of the active population aged 18 to 65 years old in the regions of Castile and Leon developed a kind of enterprise. Most of these entrepreneurs are men (53.4%). There is a high presence of men in the agricultural sector, and women in the tourism sector. The average age is 39-37 years. As for the future, 36.6% have positive expectations about the economic situation for two years. In the provinces, the highest expectations are observed in Salamanca and Zamora. 26.9% expect to hire employees over the next two years.

Despite growing demand in the labor market, the supply of ICT specialists continues to be below the EU average. Most Spaniards make good use of various online services. Spain has made the most progress in using the company's digital technology. Most Spanish companies turn to social networks, e-billing, cloud services and e-commerce. Spain is on the 45th place in the global ranking of the use of technology in enterprises.

Tourism stands out among other activities by positioning in social networks and web technologies that are practically not used, for example, in the agricultural sector. In commerce, cloud computing is becoming more common, while the largest percentage of open source software comes from services. More established technologies (equipment and the Internet) are widely used in the agricultural sector, but for other indicators only less. Cloud computing and Intranet are almost never used in Spain. DSL is the main type of Internet access (55.9%). Below ten percent frequent access: Wi-Fi, satellite

access, mobile broadband and cable TV. Spain has improved in terms of human capital, but still below average.

3.4. Krasnodar region (Russia)

The population of the region is 5,648,254 people for 2019. The region takes the third place among the subjects of the Russian Federation by the number of inhabitants. The population density is 74.83 people / km2. The urban population is 54.44%. The level of urbanization is lower than the national average (74.48%) (Rosstat, 2019). By January 1, 2016, 426 municipal formations were formed in the region, including: 7 urban districts, 37 municipal districts, 30 urban settlements, 352 rural settlements.

Figure 6: Krasnodar region (Russia)

In the sectoral structure of regional GDP, transport stands out (16.2% versus 8.2% for Russia as a whole) and agriculture (16.0% versus 7.8%). The share of industry compared with the average Russian indicator is two times lower - 16% (against 33% in the Russian Federation as a whole and 23% for the Southern Federal District).

An important sector of the economy of the Krasnodar Region is tourism, which is actively developing on the coast of the Black and Azov seas, as well as in the mountainous and steppe regions of the region. The contribution of tourism to the GRP of the Krasnodar Region as of 2016 was 14.2%.

The number of officially registered unemployed at the end of 2016 is 17,000 Kuban, which is 0.6%, which corresponds to the figure of August 2016. Of these, 60% are women, 40% are men (Saibel & Kasimova, 2016).

A positive financial result of the activity was provided by 69.6% of the observed organizations of the region. Krasnodar Region is one of the all-Russian leaders in the development of small and medium-sized businesses. According to the department of investments and development of small and medium-sized enterprises of the Krasnodar Region, for 9 months of 2017, the number of small and medium-sized businesses increased in the region by 12.4 thousand units (to 333.5 thousand units). During the same period, the number of people employed in SMEs increased by 12 thousand people – up to 798.5 thousand people. The turnover of SMEs increased by 4.2% to 1.567 trillion rubles, and the volume of investments in fixed assets by 9.9% increased to 33 billion rubles (Belyanin, 2017).

3.5. Analysis and results

In order to correctly understand the development trends of ICT in the explored regions, it is necessary to briefly discuss their features and role in the economy.

An analysis of the data presented in the table 3 shows that the South of Russia is a region in which a huge part of the country's total agricultural output is produced; it is a leader in construction and trade. The largest process takes the industry, which includes: the extractive industries, industrial processing, electricity, gas, steam and air conditioning, water supply, sanitation, waste management and decontamination (Poctep, 2014), (Abdrakhmanova, Vishnevskiy, & Volkova, 2018).

For Spain, it is worth noting the similarity of the weight of industry, agricultural activities, as well as construction, observing small differences in relation to different

types of services. Trade, hospitality and communications also have about the same weight.

The territory of Portugal is characterized by a large presence of industrial and small service companies. The most popular activities are agriculture, commerce, transport, construction and hotels.

The labor market in both Spain and Portugal is characterized by a very low level of workforce, the lack of workers with appropriate qualifications for the needs of industrial fabric, a low level of entrepreneurship as a result of the lack of youth. Companies that are particularly small tend to have a longer lifespan, being giant companies.

Table 3: Sample distribution

	Castela e Leão	**Alto Trás-os-Montes**	**Krasnodar region**
Industry	23.7%	26,5%	15%
Construction	7.3%	3,5%	19%
Trade	9.1%	9,7%	16%
Tourism	18,2%	8,0%	3%
Social services and education	3,6%	12,4%	13%
Agricultural sector	10,9 %	9,7 %	13%
Business services	12,7 %	14,3 %	10%
Other services	14.5%	15,9%	11,1 %

Figure 7 and table 4 shows companies' responses on the level of ICT utilization. Conclusions: in Spain, more than 50% of companies have an average or higher than average level, but about 30% are still at a rather low level. For 60% of companies in Portugal is characterized by a low or medium level. In Russia, about 70% of companies are at an average and high level of development.

Table 5 presents the ICT equipment. They are different in each region, however, similarities can be identified: the largest percentage of companies uses mobile devices and Internet technologies, but cloud computing and the Intranet are poorly implemented. At microenterprises, office equipment and document scanning systems are most common. But entrepreneurs are using more intranets, clouds, web social networks and open source software.

Table 4: Level of ICT use in enterprises by region

	Castela e Leão	Alto Trás-os-Montes	Krasnodar region
Very high	14,84%	7,95%	13,2%
Quite high	4,4%	16,35%	9,5%
Moderate	42,42%	33,5%	52,5%
Low	10,7%	35,25%	15,6%
Very low	27,44%	5,6%	8,9%
No answer	0,2%	1,35%	0,3%

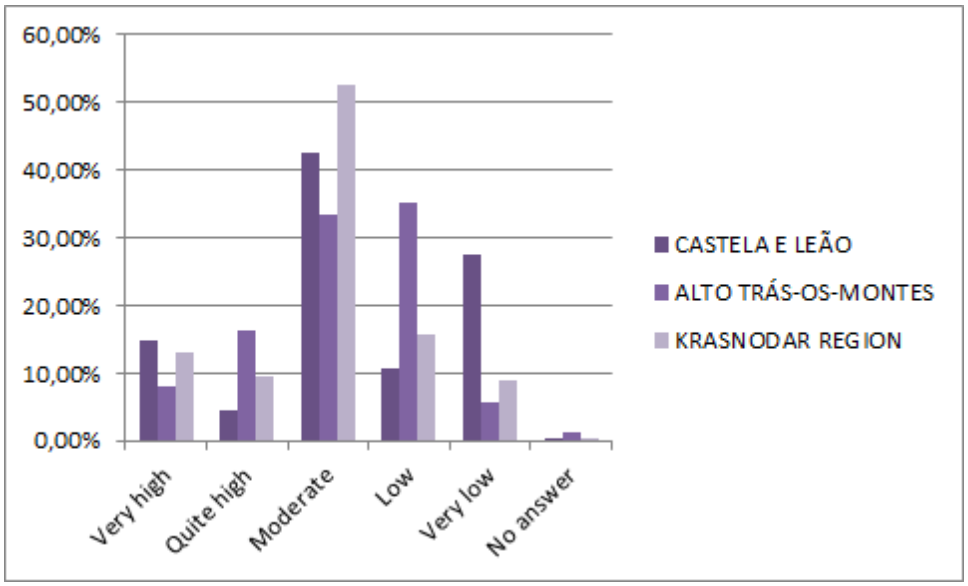

Figure 7: ICT use in the explored regions

In Spain, the use of websites and social networks is most noticeable in tourism and in agricultural sector. Cloud computing is more common in commerce, and open source software reaches the highest percentage in services. In the agricultural sector, there is a high deployment of more established technologies (hardware and Internet). By province there are significant differences. The most common websites are in the regions of Leon (26.3%) and Salamanca (24.0%), laptops in Valladolid (75.0%) and Zamora (74.0%), storage solutions in Zamora (58, 0%), and the system of checking attendance in Valladolid (21.4%). Open source software is more widely used in Valladolid (18.5%) and Leone (12.0%).

In Portugal, a high proportion of companies use open source software (60.0%). By region, the use of different technologies is uneven: desktop computers, mobile devices, cloud computing, social networks, a website and open source software are more

common in Alto Tâmega. The remaining technologies have a greater presence in the region of the Earth Trás-os-Montes. Portugal is also a leader in the use of social networks, cloud storage and Intranet.

Table 5: ICT in companies

	Castela e Leão	**Alto Trás-os-Montes**	**Krasnodar region**
Computers	72,42 %	88,4 %	96%
Document scanning system	43,4%	55,6%	57,3%
Data storage solutions	49,4%	43,9%	54,2%
Automatic presence control system	17,7%	5,9%	4,6%
Internet connection	66,98%	86,4 %	89%
Video projectors	11,9%	8,2%	7,3%
Backup system	56,8%	42,1%	53,5%
Intranet access	10,5%	13,5%	12,3%
Fixed broadband connection	85,7 %	86,4 %	74.5%
Mobile broadband connection	74,04 %	87,7%	99,8%
Internet connection and website	55,0%	46,2%	36,5%
Social media	53,2%	63,2%	44%
Cloud computing service	9,3%	32,2%	19.0%
Open Source Software	11,6%	59,7%	10%
Trusted anti-virus and anti-malware	80,1%	50,6%	87,6%
CRM-, ERP-system	41,5 %	32 %	14,5%

In many ICT indicators, the Krasnodar region has historically lagged behind developed countries. This problem is almost eliminated. For example, personal computers are present in each organization and their share has reached saturation at the level of 95-100% of the surveyed organizations. Most of organizations (80-85%) use special software. Until now, new management solutions based on modern software (CRM, ERP, SCM - systems) are poorly used in Russia, only 7-10% of surveyed organizations use them. The lag in this direction of the Krasnodar Region is due to the insufficient share of foreign direct investment by international companies in which these software tools are already integrated into the management system. Also in Russia, social

networks and websites are not sufficiently implemented in SMEs. For comparison, similar data, but by countries, are presented in table 6.

Table 6: Intensity of using digital technologies in organizations by countries

	Spain	**Portugal**	**Russia**
Broadband internet	97%	96%	81%
Cloud Services	18%	18%	21%
RFID technology	15%	11%	6%
ERP systems	46%	40%	17%
Electronic sales using special forms posted on the website / extranet, EDI systems	19%	19%	13%

Table 7 provides more detailed information on the use of management applications. Portugal is a leader in the use of ERP and CRM applications. Russia is significantly lagging behind in these indicators; however, business intelligence technologies are much more widespread.

Table 7: Management applications

	Castela e Leão	**Alto Trás-os-Montes**	**Krasnodar region**
ERP	23,7%	50,0%	18.58%
CRM	6,5%	23,5%	11.06%
SCM	1,1%	3,5%	6.87%
BI	4,4%	1,2%	10%
BSC	1,6%	4,7%	5,8%

3.5.1. Internet connection

Speaking about the speed of Internet access, the surveyed companies answered the following. In Spain, a higher percentage has a speed of 2 to 10 Mb / s, only 5.6% of companies have speed lower than 2 Mb / s, and 3.6% have 100 Mb / s. In Portugal, 44.4% of companies have a speed of 100 Mb / s. Only 0.6% – less than 2 Mb / s, 2.5% – up to 10 Mb and 4.9% – up to 30 Mb. In Russia, 57.5% of companies use

speeds from 10 to 100 Mb / s, 16.1% of 100 Mb-1 GB / s. and 19.5% of companies – less than 10 Mb / s. And about 46.2% of respondents in all regions do not know what the speed should be (in accordance with the agreement). Figure 8 shows average connection speed and coverage over 4 and 10 Mb/s. All three countries have almost identical indicators.

A high level of ignorance among executives of companies about the speed of connection under the contract was noted: 46.2% indicated that they did not know what the speed should be. 38.0% indicate that it is less than 10 Mb.

Table 8 presents the types of Internet connections. The most popular is DSL.

Table 8: Internet access type

	Castela e Leão	**Alto Trás-os-Montes**	**Krasnodar region**
DSL (ADSL, SDSL)	56.8%	59,5%	77,9%
Cable modem	8.6%	6,1%	1,5%
Mobile Broadband	5.2%	4,7%	13,7%
Satellite broadband	2.7%	6,5%	0,02%
Wireless broadband	1,4%	4,9%	1,22%
Fiber	11.4%	5,4%	4,98%
Others	13.9%	5,3%	0,68%

Table 9 presents the data for which purpose companies use the Internet. The most popular answer in all countries is the use of email, search for information and banking transactions. Video conferences and staff training are also very popular in Russia. In Spain, the Internet is needed to communicate with customers, download programs, orders and payment. In Portugal, the Internet is popular as well for subscribing to access to electronic databases and libraries.

Subdivided by sector, in Spain, mail, electronic search and banking are most popular in the service sector and industry. And video conferencing is most popular in the agricultural sector and in trade. Regarding the use of sending and receiving transport documents, it is more common in industry and in agriculture. Banking services have the highest use among service companies, and the lowest in tourism. In Portugal, all types of ICT are most common in industry, commerce and services. When using the Internet

to contact the authorities, most companies use the Internet to receive forms, to fill out forms and send them, and to receive information from official websites. In general, widespread use is emphasized among entrepreneurs.

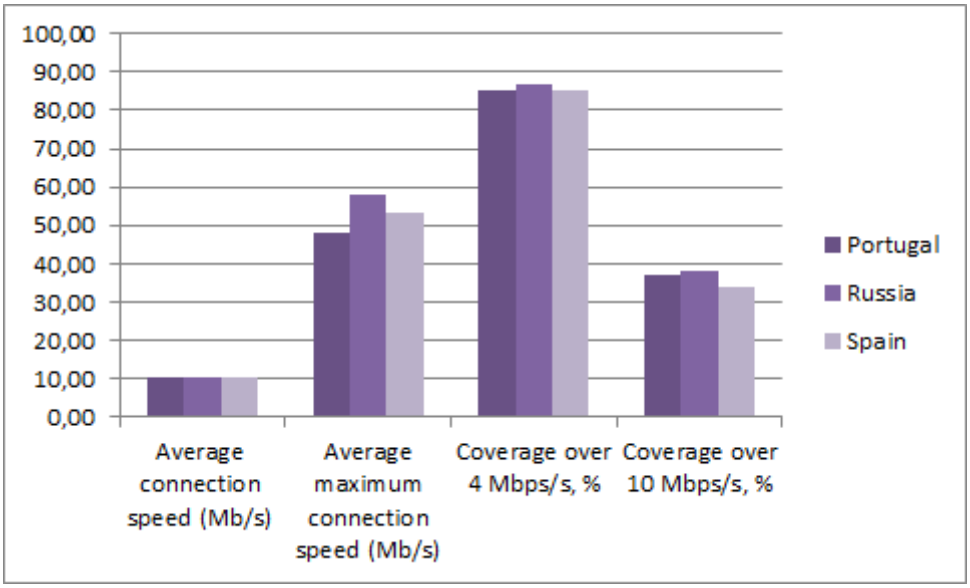

Figure 8: Internet connection

In Russia, communications, hotel business and manufacturing are leading the way in email. However, ICT is underdeveloped in the transport sector. It is worth noting that more than 90% of all trading in the supply of goods, the performance of work and services in Russia takes place on electronic platforms.

Almost all surveyed companies have access to the Internet. The reasons why some companies do not use this technology are associated with the cost of maintenance and connection (26.6%, 30.8% and 30.4% respectively).

Cost structure (Vysokov, 2015):

- Purchase of computer equipment and software.
- Pay for telecommunication services.
- Pay for access to the Internet.
- Employee training.
- Pay for third-party organizations and ICT specialists..

Table 9: Directions of use of the internet in organizations

	Castela e Leão	Alto Trás-os-Montes	Krasnodar region
Using Email	97.9%	96.9%	83.1%
Search for information on the network	92.6%	82.1%	83.5%
Banking and other financial transactions	89.3%	71%	64.5%
Staff training	29.1%	20.9%	39.7%
Video conferencing	16.2%	15.4%	36.6%
Internal or external recruitment	22.4%	5,4%	35.8%
Subscription to access to electronic databases, libraries	12.9%	15,3%	27.5%
Order / online payments to suppliers	80.5%	51.2%	25,8%
Providing information / customer feedback	62.5%	46.3%	50,3%
Download programs	51.1%	14.8%	26.7%

The study also identified the following reasons: suppliers and customers do not use the Internet, employees spend a lot of time, and there is uncertainty about security on the Internet.

3.5.2. Security

Security is important when it comes to third-party cloud solutions. Ninety-five percent of IT managers who are interested in using third-party cloud solutions consider that data security and confidentiality is the main obstacle to transferring their data to external cloud service providers.

Speaking about computer security, which is an important aspect in business, only 4.6% of companies did not take care of protecting both personal and business data. 9 out of 10 companies have implemented at least one security measure. All surveyed companies are interested in deploying security measures. Table 10 presents the most popular ways of ensuring security in companies in the regions reviewed.

In Spain, 89.2% have already implemented them to some extent. 80.1% have antivirus, 79.5% protection of personal data, 78.9% have an updated operating system, and 67.7% make backup copies regularly. The least implemented measure is security plans and

updates. With regard to various sectors of the economy, in the service sector, 95.0% of companies have implemented some security measures. On the other hand, there is a lower percentage in trade and agriculture (82.1% and 88.0%, respectively).The most common measures in various sectors are antivirus and operating system update.

Table 10: Security policies by region

	Castela e Leão	**Alto Trás-os-Montes**	**Krasnodar region**
Technical means of user authentication	72,3%	93,5%	64.4%
Software preventing unauthorized access to malware	15,36%	26,32%	18,5%
Regularly updated antivirus programs	80,1%	50,6%	87.6%
Firewall and spam filter	64,7%	37,1%	57.5%
Computer or network intrusion detection systems	79,5%	40,6%	33.8%
Backing up data to media	67,7%	55,3%	31.2%
The operating system is up to date	78,9%	62,4%	58,7%
Always use original software	64,5%	61,2%	78%

Interviewed companies in Portugal also attach great importance to security. 93.5% indicates that information is available only to those who are properly authorized, 62.4% – the operating system is up to date, and 61.2%, who always use the original software. Also, about half of the companies indicate that they back up regularly, their antiviruses are reliable and constantly updated.

Compared with Portugal and Spain, Russia faces security problems three times less. However, the security surveyed companies is not neglected. About 4% of companies even use biometric user authentication tools (Abdrakhmanova, Gokhberg, & Kovaleva, 2015). In the transport sector, the highest percentage of antivirus updates (95.9%), about 90% of the use of electronic signatures is allocated to the service and communication sectors. Strong authentication tools are popular in the mining industry (59.1%). However, the largest percentage of backup is in the field of communications (44%).

3.5.3. Challenges for ICT implementation

The main "brakes" of ICT use in small and medium-sized companies are the following provisions (table 11). Any changes in this case require a budget, and many managers simply are not afraid of return on investment. A huge problem is also the lack of sufficiently qualified staff. On the other hand, there are external barriers that do not allow achieving the desired level of scanning. This, for example, lack of infrastructure or difficulty (impossibility) of access to the Internet, it is worth mentioning the difficulties with the speed of access to the network. In addition, companies note insufficient supply of adaptation solutions for each company.

Table 11: Problems with the implementation of ICT

	Castela e Leão	**Alto Trás-os-Montes**	**Krasnodar region**
Lack of technical connectivity	17%	11,3%	7,8%
Lack of skills for work	15,36%	26,32%	18,5%
Lack of government support	10,08%	7,24%	9,7%
High connection costs	25,6%	30,78%	30,4%
These solutions do not meet the needs of the company	11,6%	7,8%	11,3%
For security and privacy reasons	10,68%	8,96%	12,1%
Lack of awareness	8,96%	7,6%	10,2%

3.5.4. Main goals

All surveyed companies expect increased functionality and customer service. Least of all expectations in the implementation of ICT is the creation of new products and services. In Portugal, they also do not expect a quick response to market demands. And in Spain they want to enter new markets and increase the share of existing ones. Entering new markets, as well as reducing costs, are certainly the most important in trade and tourism (62.2% and 43.7%, respectively), the study of new contacts and opportunities is in the service sector (64.7%). Russia expects an increase in sales and increased competitiveness. It is expected that the introduction of ICT will develop in related industries such as Big Data, Quantum Technologies, Robotics, Artificial Intelligence and Neurotechnology, as well as the industrial Internet and wireless

technologies. Thus, this will lead to a number of advantages, and the following tasks will be solved (Abdrakhmanova, Vishnevskiy, & Volkova, 2018):

- Creating new high-tech workplaces.
- Solving specialized tasks.
- Replacement of conventional computers.
- Achieving production flexibility.
- Reduction of energy costs.
- Replacement of people during routine operations.
- Production monitoring online.
- Business process optimization.
- Increase in product quality.
- Reduction of production costs.
- Replacement of low-skilled labor.
- Removal of geographic barriers.

Table 12: ICT implementation results

	Castela e Leão	**Alto Trás-os-Montes**	**Krasnodar region**
Improving the functioning	61,5%	68,2%	74%
Improved customer service	61,5%	62,9%	59,7%
Increased sales	45,1%	54,1%	42%
Exploration networking opportunities	52,2%	42,9%	39,2%
Provide competitive advantages	42,1%	42,4%	42,6%
Reduce costs	39,4%	35,9%	38%
Increased market share	47,0%	35,3%	32,4%
Integration processes	41,1%	35,3%	27,8%
Penetration of new markets	48,5%	31,2%	46,5%
Rapid response to new markets	43,9%	25,3%	48%
Creation of new products / services	35,0%	15,9%	22,4%

For the production of ICT, it will be possible in a reasonable time to study a wide enough range of alternatives for a possible list of manufactured products, types of raw materials, materials, equipment and technologies. Knowledge of a wide range of alternatives allows you to choose the most creative and optimal option in terms of local resources available: location, delivery methods, rational use of resources, production of individual products, packaging products and related services. Finally, ICTs make it possible to organize business processes inside the enterprise in a different way. In a network economy, the cost of designing a business is no less important than the implementation of the project.

In the field of marketing, ICT significantly expands the concept of market segments, allows forming new classifications for developing a marketing strategy. It is worth considering here not only individual segments: business (B - business), consumers (C - consumer), and the state (G - government), but also the connections between them. ICT allows using new network distribution channels for products by registering and creating priorities in search engines, advertising on thematic sites, banner networks, exchanged links and e-mail marketing. The presence of the site is a mandatory element of the culture of modern business. In the most advanced companies, the site provides not only information, but also all the technological procedures for fulfilling a customer's order, including pricing, delivery methods, incentive programs. ICTs accelerate interaction with customers, partners and the regulatory environment.

As for personnel, ICT allows to go to remote interaction with personnel, especially with highly qualified specialists.

In the field of finance, ICT allows to monitor market behavior, problems in the production and control personnel, generate creative solutions that affect the final result of public recognition of a business - profit. ICTs allow you to quickly evaluate various business financing schemes and more quickly identify reserves for improving business processes. ICT also allow the use of more efficient payment and settlement systems.

3.5.5. Big data adoption

Big data and Machine Learning technologies are applicable in small and medium-sized businesses of any industry, where there is a need to collect and analyze large amounts of multi-format information. Information from corporate systems, e-mail, file storage,

paper records, archives and social networks are all sources of data for Machine Learning models and algorithms that will allow attracting new customers and keeping existing ones. Even 5 years ago, in 2014, 70% of large companies had already planned to use Big data and Machine Learning, and in the small and medium business sector this figure was 56% (Vichugova, 2019).

Many IT managers consider Big data analytics projects as one of the most important imperatives for their organization. Figure 9 shows the growth rate of the Big data market by region (IPOboard, 2015), and figure 10 shows the goals of Big data use (Moustakerski & Kim, 2015). Primary data sources are documents, e-mail, sensor or device data, and image data. Now for small and medium businesses it is most beneficial not to deploy the Big data infrastructure on their own capacities, but to use the SaaS software.

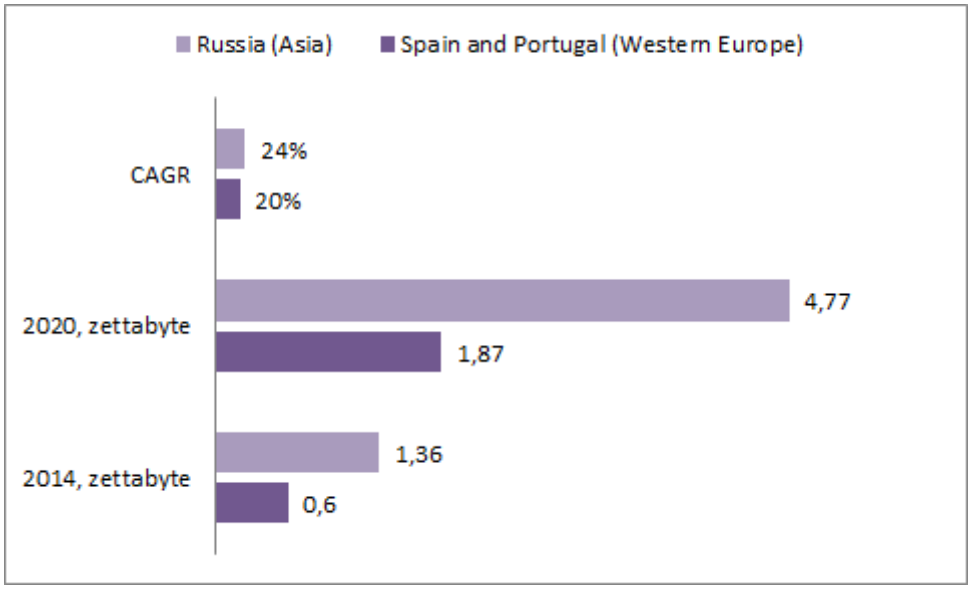

Figure 9: Big data market growth rates by region

However, even in this case, the company needs a competent expert in the field of Big data who can analyze them effectively, choose the most profitable algorithm and formulate a promising hypothesis for Machine Learning.

Some statistics: 65% of business and IT executives believe that if they fail to work with Big data, they risk worsening their relevance or competitiveness. In addition, 64% of respondents believe that Big data crowd out the traditional business framework, and

24% are experiencing the invasion of competitors from other related sectors of the economy. Therefore, the goal of many organizations today is to find an applicable and efficient way to use Big data in their business (Capgemini, 2016).

To obtain positive results, it is not enough just to have the data; you need an appropriate infrastructure and analysis system (taking into account the limited budget and technical knowledge of companies). SMEs usually do not have the ability to independently control a large server and data operations.

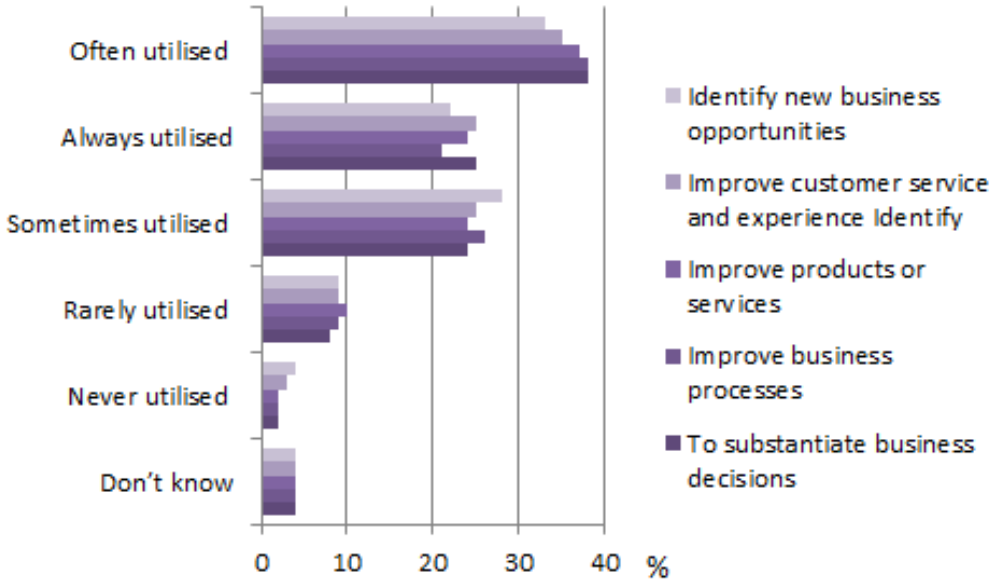

Figure 10: Goal and utilization of Big data

Therefore, SMEs should consider a cloud alternative to conventional servers in order to reduce both the costs and complexity of the process of interacting with information. The Big data infrastructure deployed in the cloud will enable SMEs to access the benefits of complex IT operations that are otherwise unavailable due to high costs and the necessary upfront investment.

If we talk about data processing and storage, then these tasks can also present certain difficulties for SMEs. Apache's Hadoop1 solution can be a convenient data management platform for SMEs, as it is efficient to use, allows customization and low maintenance costs.

The next stage is data analysis. The best option for SMEs is visualization. Data visualization is a key parameter that, with proper attention, helps to extract meaningful information much faster. It is this information that can later be used to make business decisions. For beginners in analyzing Big data by SMEs, such solutions will help reduce costs and the level of skills required to work with analytics. There are few data specialists and their services are really expensive, so the output for small companies is open and often free online training courses (Coursera.org), as well as training materials from vendor companies.

Finally, SMEs should consider the need to create an Information Governance policy to ensure quality control, security and ownership of information, especially during the transition to new data methods.

Although small companies usually have limited resources, they have their own advantages when implementing solutions for Big data. For example, more flexible and easily changeable IT infrastructure, small number of system failures and disparate databases, the ability to quickly change the established principles of work (Pichugina, 2017). And even if a small company cannot afford the introduction of expensive analytical products, it can follow the following recommendations to improve its competitiveness:

- Pay attention to cloud technologies that offer turnkey solutions in the field of business intelligence.
- Choose an infrastructure that will help fulfill the identified needs of the business.
- Take measures to organize quality control and safety of available data.

3.5.6. Challenges for Big data implementation

Various factors lead to the failure of Big data analytics in SMEs. More common and relevant factors for explored companies are identified below (Katal, 2017).

- Misunderstanding.
- Cultural barriers and intrinsic conservatism.
- Lack of in-house data analysis specialists.
- Lack of professionals.
- Lack of useful and accessible consulting and business intelligence services.

- Lack of intuitive software.
- Lack of management and organizational models.
- Concerns about data protection and data privacy (95%) (Intel, 2015).
- Financial barriers.
- Data security.
- Data management and data quality.
- Data discrimination.

The main problem is also the growth of data, as well as the costs and effort required to store them (48% of the companies surveyed). Companies also note concerns about the data infrastructure and the ability of their data center to provide the scalability, low latency, and performance required to process large data (41%). However, despite the difficulties, managers note that in most cases the introduction of Big data is justified.

3.5.7. Wrap-up and closing remarks

For each country studied, it is possible to use already proven technologies without the risks and costs of innovative searches. Investigated areas are characterized by population dispersion, low density and high level of aging. In this demographic situation, the introduction of ICT is necessary already at school, i.e. start learning not only computer science, but also the use of ICT for self-study of other subjects.

Spain

The economic structure of the analyzed Spanish regions is characterized by a high proportion of the agricultural sector, as well as some services (in particular, personal and social). Industry (automotive, mining, woodworking and agro-food sector) has medium weight, and construction is very concentrated in some areas.

Most entrepreneurs started their activities when they found the first business opportunity (65.4%). 74.2% acknowledged that there were some difficult to start their activities, the greatest problems: the lack of necessary rules and procedures (43.1%) and the search for funds (21.7%). Three out of four companies have computers, 93.3% have internet connection, and 90.2% companies have mobile devices. In contrast, only 9.3% have access to cloud computing, and 10.5% have access to an intranet. The most

commonly used technology is DSL, and 46.2% of respondents indicate that they do not know what the speed of the Internet should be in accordance with contract.

With regard to the use of the Internet, most companies traditionally use to manage e-mail, search for information, banking tasks and send or receive product information (more than 70%). On the other hand, only 15.3% use the Internet for video conferencing. 55.0% of companies have web pages, 11.6% use open source software, and 67.5% do not have any management tool. Companies show great interest in security measures: 89.2% implemented some of them.

With regard to equipment, there are large differences by sector: in the services sector there is a large presence of various hardware elements, with the exception of office computers, which are more common in industry and agriculture, mobile devices are common in agriculture and industry, and projectors in tourism. In the latter sector there are also social and web networks.

Among companies located in municipalities with a population of less than 5,000 inhabitants, there is no positive perception regarding the introduction of information and communication technologies. Thus, in rural areas there are more companies that believe that they have low or very low ICT usage (36.9%) than high or very high (18.8%).

Portugal

Most of the entrepreneurs surveyed in this study began their activities by chance (41.2%). The level of ICT perception among Alto Tâmega and Alto Trás-os-Montes companies is low or very low (38.8%). This value is lower in Alto Trás-os-Montes (34.5%) than in Alto Tâmega (47.4%).

By region, the use of different technologies is uneven: desktops, mobile devices, cloud computing, social networks, a website and open source software are more present in Alto Tâmega. The remaining technologies have more presence in the region Alto Trás-os-Montes. Implemented technology: Internet access (95.3%) and mobile devices (88.2%). Nevertheless, systems of automatic control of presence (5.9%) and projectors (8.2%) are poorly distributed in companies. 44.4% of companies indicate a speed in excess of 100 Mb /s; however, 39.5% found it difficult to answer.

The main difficulties identified are mostly internal: maintenance costs (69.4%) and lack of human capital with experience in the field of ICT (55.3%). Very small markets due to population dispersion also became a problem. Portugal represents its greatest strengths in communications and digital public services. About 25% of Portuguese companies have a high or very high digital usage, compared with the EU average (21.5%), but over the past year in this area, the surveyed area fell from 9th to 11th place in standings. And on the other hand, the percentage of e-commerce business volume (16%) is almost two percentage points below the EU average.

Russia

In the regions of the South of Russia, they know and use ICT, but do not risk taking the initiative in their development. It was noted that the low incomes of many companies do not allow the use of ICT opportunities to increase these incomes, limit the use of ICT in management and science, where they could have the greatest effect on income growth. Speaking about the market potential, the use of ICT in agriculture, construction, and small business in the Krasnodar region is of particular interest.

For the development of ICT in the South, Russia needs not narrow specialists, but applied specialists who are able to develop various sectors of the economy on the basis of ICT.

Mobile penetration and increased access to rural ICT services are creating new markets and opening up new opportunities to take advantage of ICT.

By the level of personnel specialization (younger than 35 years), Russia is in third place (56%), the same values for Spain and Portugal - 36 and 37%, respectively. Cloud services have become one of the most dynamic areas of the IT market in Russia. In 2016, the total market volume reached $ 422.11 million and continued growth in 2017–2018, increasing by 11.8%. Over 80–85% of organizations use email. About 70% of organizations use local area networks, and about 20% use wireless local area networks. About 20% of organizations use wireless access to the Internet, including 12 - 15% use high-speed access. The Intranet is used by 10 - 15% of organizations, Extranet - 5 - 6%. 10% use open operating systems, and almost 90% of organizations use the Internet in their work. Broadband Internet access is used by 75% of organizations, and almost half – ultra-high speed Internet access; in the South, these indicators are still below the

national average, but the gap is narrowing. The gap between the South and Russia in the share of organizations with a website is reduced. At the same time, almost 15% of organizations allocate technical resources to their employees for mobile Internet access, but only 1.5-2% of employees use these funds. And only about 6.5% of organizations use ERP-systems.

Despite the growth in the Russian ICT market over the past few years, there are a number of factors hindering the development of this market. First, it is the monopolization of the ICT market in Russia. Secondly, low investment attractiveness of the ICT services market. Third, the ousting from the domestic market of Russian producers of information technologies, telecommunications and communications, as well as an increase in the outflow of specialists and right holders abroad. Nevertheless, the ICT-costs of the regions in 2018 increased by 9%.

3.6. Proposals to improve the ICT level

There are alternative solutions in each area of management, and this creates conditions for the effective use of ICT, by speeding up the search for alternatives, by automating the construction of options for combinations of alternatives in production management, marketing, finance and personnel. The small business success formula begins to work at a tremendous rate, but it is always necessary to evaluate your business as part of a networked economy and, with the help of ICT, quickly assess not only direct but also feedback from the decision and external impacts.

ICT growth is accelerated by active infrastructure. The following recommendations were formed during the study:

- Not only take into account, but also effectively manage the risks of ICT.
- Develop new rules, procedures and technologies for the work of the authorities and local self-government on the basis of ICT.
- Stimulate entrepreneurship (services such as: installation and maintenance of ICT, graphic design, financial advice, legal advice for companies, etc.).
- Promote ICT related technologies.
- Conduct incentive programs, establish subsidies and introduce motivational programs.

- Develop opportunities for remote work.
- Economically support specialized training based on technology startups.
- Provide economic assistance and reduce bureaucratic documentation.
- Create more jobs in higher schools offering ICT-related courses in information management.
- Make efforts to raise the awareness of companies and entrepreneurs about ICT opportunities.
- Publish a list of various ICT-related technologies so that each company can choose those that are or may be more useful in its activities.

3.7. Recommendations for the Big data implementation

Before embarking on the Big Data Deployment program, the current state of maturity regarding the proper management and use of data should be first assessed.

Assessing the company's maturity

A preliminary assessment of an organization’s readiness to use data can be made in a systematic way by adopting a proper reference system. Using this help system, also called the maturity model, you can identify and diagnose the current state of affairs in the use of data in an organization, on the basis of which you can correctly develop a plan for developing and implementing Big data. The analysis of various models of maturity will be most complete when using the following measurements:

- The level of business strategy.
- How effectively the process of collecting, storing and retrieving data is managed.
- Availability of specialized specialists and analytical skills.
- Technological infrastructure.
- How extensive is the company's participation in data management.
- How companies maintain a culture of efficient data use for managing operations and business processes.

Organizational models in SMEs

After assessing the maturity level, it's necessary to define an organizational model. There are the following options: to gather a group of specialists in one department, to allocate a data specialist for each department separately or to gather self-organized units in which employees will analyze data in conditions of limited resources as necessary. The last version is the best option for SMEs, since it is simple enough to organize additional training for existing staff.

Getting the first positive results will make it easy to start a "revolution" in other departments, etc.

Identify goals and requirements

Each manager must answer the following questions:

- Do I have enough reliable data?
- I have data. What do I want to do with them?
- I know what I want. What are the algorithms of work?
- What software and hardware do I need for this?
- What kind of staff do I need?

It is also necessary in the initial stages to determine the costs, risks, liquidity of the asset and profitability from it.

Chapter 4 Conclusions and Future works

In the presented work, big data technology, data mining and ICT were investigated. The ICT level was assessed in three regions: Alto Trás-os-Montes, Castilla y Leon, and Krasnodar Krai. The state of companies is at different levels depending on the regions and areas. Castile and Leon is below average in the use of new technologies in enterprises. The level of ICT perception among Alto Tâmega and Tras os Montes companies is low or very low. The level of ICT use in the Krasnodar region is also below average, however, given the accelerated reduction in the income gap of the population, it is possible to get a fairly quick effect when teaching ICT to low-income users.

ICT and Big data technologies will penetrate into various spheres of human activity, and perhaps the greatest effect from this penetration will be achieved where it is least expected. When analyzing specific technologies, the integration of more common ICTs (Internet access, mobile devices and computers, both office and portable) is at a high level in all the regions studied. As for management applications, they are poorly distributed in Portugal and Spain and are practically not used in Russia. The most popular type of Internet access is DSL, and the most common speed for Russia and Portugal is 100 Mb / s, and in Spain it is 10 Mb / s. Companies use the Internet mainly to search for information, mail, customer relations and conduct various financial transactions.

With regard to security, all the companies studied are concerned about this issue, information is available only to properly authorized, antivirus programs are widely used, and software and OS are regularly updated.

The main objectives of the introduction of ICT are attracting new customers, reducing costs, improving services and increasing revenues. However, all companies are faced with problems of lack of funds and government support, as well as an acute shortage of staff. These problems likewise constrain enterprises in their desire to use Big data technologies that could not only significantly develop a business, but also help in making decisions and bring them to new markets.

The euphoria about the information society and the network economy is an important element of the marketing strategy of the state and large companies, but to realize the real benefits of ICT, independent individual work is needed on the development and use of ICT.

To sum up, the third part of the explored enterprises have an intention to invest in ICT in the next two years. And their differentiated structure of the economy provides a good testing ground for the implementation of the best world practices. Also, for the development of ICT in selected regions, not narrow specialists are needed, but applied specialists who are able to develop different areas of the economy on the basis of ICT.

In the work, a comparative description of ICT by categories has been conducted, their capabilities and advantages have been analyzed. Recommendations for the implementation of Big data technologies have been developed and the associated difficulties identified. The advantages of SMEs in comparison with large companies are also revealed.

The result of the study can help managers to lead their businesses to a new level, in view of the possible risks. These results may be useful for the modernization of ICT, as well as for understanding the possibilities of using ICT by small business entities in different areas of activity. Target audience - students and teachers, ICT users, developers of programs, services and applications, heads of enterprises and organizations.

In the future, this work can be expanded by analyzing the differences between the level of ICT use not only of small but also of large companies in Russia, Portugal and other countries of Europe and America, in order to identify the causes of fragmentation, development tactics, and best practices. More in-depth consideration of the Big data

technologies use will allow qualitatively improving goods and services, restructuring small and medium business strategies and achieving a new level of economy.

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