THE INFRASTRUCTURE OF LARGE ENTERPRISES IN BULGARIA – CHARACTERISTICS AND PROBLEMS

Assoc. Prof. Petya Emilova, PhD [1]
Teodora Spasova, PhD Student

Abstract: An information infrastructure is part of the overall infrastructure of enterprises. It refers to hardware, software, data management technologies, network and telecommunication technologies and services as well as the staff involved in the management of provided services.

The aim of this article is to elucidate the characteristics of information infrastructure and related issues in the era of digital transformation. In terms of theoretical tasks, this implies defining the concept of "information infrastructure" and identifying opportunities for its development. Practical tasks relate to analyzing some of the problems that a large Bulgarian enterprise is facing in terms of its information infrastructure and proposing methods for assessing the costs of the information infrastructure in the enterprise. Our research focuses on 'Sparky Eltos' AD in Lovech and suggests some practical guidelines for analyzing problems and offering adequate solutions.

Key words: information infrastructure, large enterprise, digital transformation.

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[1] Assoc. Prof. Petya Emilova, PhD is the author of the Introduction and Part 4; PhD Student Teodora Spassova is the author of Parts 1, 2, 3 and the conclusion.

Introduction

Digital transformation processes in business have rendered information infrastructure a vital resource for organizations. It is no longer sufficient for businesses to possess valuable information, to generate knowledge or to automatically manage business processes. Information resources need to be constantly accessible and protected. Processing technologies and systems need to be highly efficient and operations need to be performed effectively and sustainably. Those functions are primarily implemented by the information infrastructure of enterprises and its development nowadays is influenced by multiple technologies.

The aim of this article is to outline the characteristics of an information infrastructure and to identify major issues in the era of digital transformation by solving theoretical tasks, such as: defining the concept of information infrastructure and identifying trends in its development so as to ensure greater efficiency. In terms of its practical tasks, the research focuses on the characteristics of and issues related to the information infrastructure of a large Bulgarian enterprise ('Sparky Eltos' AD in Lovech) and the methods that can be employed in assessing the costs of developing and maintaining the information infrastructure of the company.

1. Information Infrastructure

Digital transformation processes affect all spheres of human activity. In the business sphere, digital transformation is the result of factors such as: the need to reduce communication costs and to ensure easy access to powerful tools and smart platforms for data processing; the huge amount of data that is incessantly genereated by communication technologies, mobile phones, sensors and applications; the increasing volume of open, free and publicly accessible data; the evolution of the communication network into a source of innovation; the appearance of new opportunities for generating significant value for businesses and society on the basis of analytical technologies and the processing of large volumes of data.

According to N. Hanna (Hanna, 2016, p.27), *digital transformation* is 'a shift to a new techno-economic paradigm' that not only automates existing activities in organizations but also implies unprecedented opportunities for designing, managing and implementing working processes. The generation and processing of huge amounts of digitized information is typical of activities such as conducting economic, social and environmental analyses; monitoring activities and resources; coordinating activities; providing services; performance appraisals and measurement of delivered services, etc. All these activities take place in real time and are maintained by a relevant information infratructure.

The term 'information infrastructure' is one of the most frequently used terms in today's highly-technological environment. Nevertheless, no uniform definition of the conept has been accepted yet, so the elements of what is defined as an information infrastructure tend to vary. Specialised literature gives different definitions that sound contradictory at times; yet, in fact they enrich and widen the scope of the concept.

Information infrastructure is part of the overall infrastructure of an enterprise. Laudon and Laudon (Laudon & Laudon, Management Information Systems: Managing the Digital Firm, 2006) define it as a set of shared technology resources that provide a platform for company-specific systems and applications. This includes hardware, software and services. The authors define information infrastructure as a set of technologies or a set of services (a service-based approach). The first definition approaches information infrastructure as a combination of hardware and software items, which are necessary for an enterprise to operate. The service-based approach defines information infrastructure as a set of services for which a budget is allocated and which imply knowledge about technology and social relations.

After researching scientific publications on the subject, Laan (2017) sheds light on the nature of information infrastructure and identifies the following characteristics:

- Information infrastructure is a collection of equipment, systems, software and services available in an organization. (Cio.gov)

- Information infrastructure refers to all the components, which are required to provide an IT service to users; it is not just hardware and software (ITILv2).
- Information infrastructure includes all the hardware, software, networks, equipment, etc. needed to deliver, monitor, develop, test, control and maintain IT services. The umbrella term 'Information infrastructure' is used to refer to every aspect of IT technology that is not related to people, processes or documents (ITILv3).
- Information infrastructure is a set of shared and reliable services that provide the basis for designing an IT portfolio of an organization (Goethe University of Frankfurt).
- Information infrastructure is the basis for building a distributed, operational and administrative computer communication environment. It is 'invisible' to the end user and includes an implicit set of protocols, networks and intermediate software that provide enterprise computing and facilitate efficient data flow distribution. Information infrastructure does not refer to a data processing and communication system only, but also to the staff in the maintenance department (the Technology Governance Board), which sets specific requirements to the knowledge and skills of employees. [2]

Information infrastructure is approached differently by individuals since points of view and their formation largely depend on the volume of knowledge and experience that the individuals have acquired (Laan, 2017).

In order to meet business demands, the information infrastructure of eneterprises must have a flexible, mobile, robust, scalable, variable, modular and adaptive architecture. Information infrastructure within companies is designed at three levels: public architecture, enterprise architecture and department architecture. Each level delivers the appropriate IT services to its users. (Laudon & Laudon, Management Information Systems: Managing the Digital Firm, 2006), (Zhaohao, 2016).

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[2] This is the definition we will employ about the concept in the article.

The design of an information infrastructure in all enterprises is based on public facilities like telephone, cable and wireless networks, public constructions, the Internet, etc., on which the second level is built. The second level is formed by a corporate website, file and mail servers, an intranet network, and enterprise-specific applications. The third level includes the information and technology structure of different sections in the entity - units, departments, etc., which may have their own different infrastructure designed according to their specific features and needs. Top-level infrastructure comprises systems for dealing with suppliers and customers, accounting and financial software and specialized applications.

According to (McKay & Brockway) and (Weill & Broadbent, 1998), the information infrastructure of all enterprises is based on public infrastructure, the industrial base, and the technological components connected by different standards, depending on the environment and the economic sector in which the enterprise operates. Internal IT corporate standards allow connecting the organization's infrastructure with that of the individual business units that may be organized differently. Shared IT services are delivered from standardized technology components. Business applications also assign tasks that are executed by the IT infrastructure. There are also services provided by people (for example, project management). The authors emphasise that people play a significant role in the enterprise's information infrastructure since they create, manage, maintain and develop that infrastructure.

2. Characteristics of the Information Infrastructure of a Large Enterprise

The information infrastructure of each organization has five major components: hardware, software, data management technologies, network and telecommunication technologies and services (see Figure 1 (Laudon & Laudon, Management Information Systems, 2009), Marinova K. (2018)).
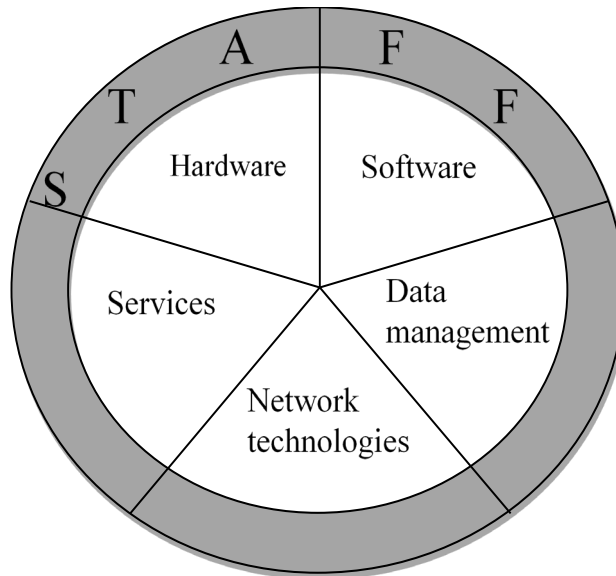
Figure 1. Major components of an information infrastructure.

Computer hardware is a set of device components for data input, processing, storage and distribution. While for a small organization it will suffice to have several workstations operating independently or within a network, in addition to a copier and some printing and scanning equipment, the requirements for developing the information infrastructure of a large enterprise are quite different. A big organization may have one or several branches that operate at remote locations and communicate over the internet. Multiple workstations are most often divided into different subnets to facilitate data sharing and to reduce workloads. There must be one or more servers to ensure data storage and control, to manage printing, to protect data and provide an email service, to maintain the website of the entity, etc. Different server functions are frequently performed by a single machine to reduce costs and to make hardware more efficient. This process is called **virtualization of resources**.

Due to the huge amount of corporate data, their importance and confidential character, storage technologies are of utmost importance to

large enterprises. In most cases, enterpriseses use hard drives (HDD or SSD), with RAID technology applied for speed and security of data storage; File Server / Network Attached Storage (NAS); optical discs - CD, DVD, Blu-Ray, etc.; Storage area networks (SANs) - remote connection through an optical path to a shared pool of storage devices.

Computer software manages the overall operation of a computer system and performs a variety of user tasks. The operating system belonging to this category is vital for businesses. It should provide opportunities for multi-user work and multitasking, use friendly interface, and, depending on the features available, function as a server or a workstation. Users in large enterprises prefer to use a graphical interface, due to its higher intuitiveness, and they predominantly employ different versions of Windows. Server software is often a FreeBSD operating system that offers a high level of security and stability. Linux distributions are also a preferred alternative since they are an open source and allow customization of features[3]. In terms of application software, business entities use office packages that enable them to create and edit texts (word processing), use spreadsheet, design presentations, manage database, use eb browsers, design company web sites and employ maintenance tools, web service technologies, utility programmes for testing the systems, anti-virus protection, archiving, etc.

Management technologies organize, process and manage business data related to the assets of an enterprise, its customers and suppliers. The information is organized into files, databases, data warehouses searched through various business analysis tools, data displays, etc.

Network and telecommunication technologies are a set of tools and techniques used to connect various parties involved in business processes - staff, clients, suppliers, and partners. Connection is established via different communication channels - voice, video, etc. The technologies employed as part of the information infrastructure of an enterprise, contribute to achieving time and cost efficiency. Network connections ensure fast and prompt data transfer within the internal corporate network, secure access to

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[3] According to a survey conducted among IT specialists in 51 large enterprises in Bulgaria.

company data to authorized outside persons, and a variety of Internet services.

The computer network of a large enterprise has specific features. It is typically built from multiple local networks in a common corporate infrastructure. WAN technologies are used to transfer data between branches. One or more corporate servers with different functions must be available – a file server, an application server, a domain controller, web, proxy, DHCP, DNS servers, etc. Video-conferencing and internet phone calls are also features used by large enterprises. The most common type of managing a network is the 'client-server' technology due to the stricter control over access. Enterprises usually design their own private *(intranet)* networks protected against external access, but when access is given, under some rules and conditions, to some outside parties, the network expands to the so-called *extranet*.

Technology services are an indispensable component of the information infrastructure of each organization. Those include all professional services designed to support the use of information technology by businesses and their end-users. Technology services include activities such as: software design, installation, integration, maintenance and development; hardware introduction, integration and maintenance; network management, integration and maintenance; information security; IT consultancy; mobile services; web applications (Technology Services at Illinois).

Staff are directly related to the proper functioning of each of the other components *and should therefore be considered an element of the information infrastructure*. Employees take care of the hardware and its work environment; IT specialists use virtualization to simulate machines; they install, uninstall, test and update software; clear errors, readjust systems, etc.; back up information and take care of antivirus protection; store data; maintain the network operating; design policies for the utilization of resources; establish contact with Internet service providers, etc. Staff proficiency is crucial for the proper performance of the entire information infrastructure in an enterprise.

3. The Condition of Information Infrastructure in Large Enterprises in Bulgaria and Related Problems

Limited funds, private interests, inadequate and, sometimes, short-sighted management, lack of qualified human resources, etc. are only some of the factors affecting the information infrastructure of large enterprises in Bulgaria. In order to accomplish the objective of our research, we examined in detail the information infrastrcutre of 'Sparky Eltos' AD in Lovech, a Bulgarian enterprise which has operated for nearly 60 years.

3.1. Hardware

The company last purchased some servers in 2007 and 2008. The average period of reliable exploitation for servers is from 3 to 5 years, hence that type of equipment has already depreciated and is on the verge of becoming obsolete. At the same time, no funds are available for the purchase of new servers and no spare capacity is available.

Virtual servers that ensure more economical and efficient exploitation of physical machines partly solve arising issues in the complexly organized infrastructure of the enterprise and reduce the costs of maintenance, e.g. electricity for power and cooling, storage space, staff, etc. They also allow certain flexibility of staff management, since it is possible to archive and deploy the contents of a server to another physical machine when a problem arises or some repair work is to be done. As a matter of fact, virtual servers are the technology that enables IT specialists at the enterprise to do their job with the available out-dated machines they have at their disposal.

Eight of the servers have two quad-core processors. Three servers have two processors with six physical and two logical cores - a total of 24 logical cores per server. These machines are used for virtualization.

According to the IT Department, total server load varies from 26% to 50%, which indicates inefficient performance, yet those are the resources needed for hoarding storage space and computing power to create new virtual machines when necessary.

Table 1.
Available servers in the researched enterprise

Function	Operating system (OS)	Physical	Virtual	TOTAL
File servers	Linux	2	1	3
Servers used by the production management system	Linux	7	1	8
Mail Server, Firewall, Dynamic Host Configuration Protocol (DHCP)	Linux	-	3	3
Server monitoring the consumption of electricity by the enterprise	Windows	1	-	1
HR, Labour and Wages, Personnel	Windows	1	-	1
	Total:	**11**	**5**	**16**

3.2. Software

There are 190 client workstations at 'Sparky Eltos' AD. Thirty of them have Windows 7 installed, five have Windows 10, and 155 of the client workstations have Windows XP and Windows Vista. This is an issue for the IT Departments, since there is no support for these versions of the operating system, and at the same time, no funds are available for purchasing new licenses. **The exploitation of outdated OSs renders maintenance more difficult in terms of protection, incompatibility with newer technologies, etc.**

The software products used in the researched enterprise include:

• *AutoCAD* – used for drawing in the Research and Development Department;

• *Pro / Engineer* - CAD / CAM / CAE – used for 3D modelling in the Prototyping Department;

• *LVM Flow* – used for simulation analysis of castings;

• *Technoclass* – an ERP II system used in the technological preparation of tools production and the overall management of the production process, inventory planning, sale of the finished products, etc. The system uses an Oracle database that can be used for SQL requests and queries from five work stations. The ERP is installed on a physical server. The most actively used modules are Accounting, Supplies, Stock, Orders,

Planning and Production. Data Maintenance Systems for Human Resources and Payroll have been integrated into the ERP II system, instead of using the available modules of the system with similar functionality. **Having external software integrated has made the maintenance process more difficult.**

    • *MS Office and Open Office* - both office packages are installed on Windows at the end client workstations.
    • *VMware* - is the software used for virtualization in 'Sparky Eltos' AD.

3.3. Data Management Technologies

Information is stored on file servers in a decentralized manner, giving the various departments the right to decide for themelves what data to store and in what format.

The total capacity of the file servers in the researched enterprise amounts to 2590 GB, 1540 GB of which are loaded with data, i.e. 59% of the storage capacity are used effectively. Data are stored either through devices directly connected for the purpose - Direct Attached Storage (DAS) or on a network-attached file server - Network Attached Storage (NAS). The volume of data not stored on file servers is 2140 GB.

Back-up copies of all data are organized to meet ISO requirements since this is subject to auditing. The weekly backup is approximately 1 TB. The database of the production management system is archived daily and amounts to around 2GB. Data is stored on a hard drive and is recorded on a DVD and a NAS device on a monthly basis. Stored data covers a period of up to 15 years earlier.

Archives make it possible to quickly retrieve and provide data as follows: data from a minimum of 15 days earlier for daily backups; data from at least 12 weeks earlier for weekly ones; data from at least six months earlier for monthly back-ups and data from at least three years earlier for the annual ERP II archives system.

Shared resources in the enterprise are located on a file server. Backups of data from the HR and the Payroll Departments and technological documentation are made every two weeks. Information can

be retrieved about up to two years earlier. The volume of daily e-mail correspondence is about 3 to 4 GB, which equals a 300 GB of a compressed monthly archive.

We should note that even the support of a single ERP or CRM/HRM system is an issue for large enterprises. In addition to the high annual licence fee, annual updates mean further costs for enterprises to restore disappearing user settings (i.e. another BGN 30,000 to BGN 40,000). It takes nearly half a year to adjust the parameters anew. Therefore, companies try to reduce the number of updates to one every three or four years. More frequent changes could be made to data stored on the cloud. **Hence, enterprises that have been using an ERP (HRM, CRM) system adapted to their needs tend to be reluctant to switch to a cloud solution.** Although at this stage the enterprise is not employing any updated versions of TechnoClass due to their incompatibility with the obsolete operating systems of the workstations, such updates should be made very four years.

3.4. Network and Telecommunication Technologies

The entire physical information infrastructure is distributed in two main networks - one of them uses fiber connections and the other is wireless. A hundred and ninety workstations are connected in the fiber network. Fibre cables run in special insulating at a height of more than five meters above the ground to prevent any intentional or unintentional damage. Active devices are housed in cabinets, which, as well as the entire network, is duly documented. Wi-Fi is accessible all over the enterprise and is password-protected. Company guests and company executives use different wi-fi systems.

Four Cisco Carrier Routing Systems are used in the enterprise, mainly for connection with the internet service providers, with 35 managed and 50 unmanaged switches. Since the enterprise in Lovech is part of a corporation, the entity is connected to the other branches via WAN through VPN, i.e. an intranet. Each office has a Linux-based domain server that allows remote access to data through single identification. The firewalls used by the enterprise are software ones only. Internet is provided simultaneously

by two providers. The main internet used in the enterprise has a guaranteed two-way speed of 30 Mbps and a backup wireless satellite connection. The enterprise pays a subscription fee of nearly BGN 200.

Internet access is high - 99.999%, calculated on the basis of approximately 4 hours of stay per calendar year.

3.5. Technological Services

There are three ISDN lines in 'Sparky-Eltos' AD, over which data is transmitted by a digital modem. They are connected to the workshops, thus making possible the remote hardware diagnistics of certain machines by their manufacturers, according to signed consultancy contracts.

3.6. Staff – there are seven employees in the IT department: three of them are at a retirement age; one is a pre-retiree; two of the IT specialists have been with the company for more than thirty years, and only one person is under the age of thirty. The findings of our research indicate that the IT processes in the enterprise are not adequately staffed. The problem is further exacerbated by the fact that there are not sufficiently qualified specialists in the town who would be willing to apply for a position in the IT Department and that the company will need to invest in the training of any young specialists it might attract.

Our research also established that **the IT specialists who work for the company are not satisfied with their remuneration since their responsibilities outweigh their pay-packets**. There are some purely psychological factors behind the employees' dissatisfaction, too. Processing, maintaining and storing large volumes of important data imply serious commitment and understandable anxiety due to the heavy responsibility these employees have to bear. This aspect should not be ignored by the managers of the company, for it too affects the recruitment process. When configuring the systems to meet the specific needs of the enterprise, **the IT specialists often detect software errors in the ERP system** and offer possible solutions. They thus conduct **product beta-**

testing, which is one of the most-highly paid activities in the IT profession. Yet, the IT specialists in the company **do not receive any payment** for the beta-test they conduct.

Four out of the seven IT specialists at 'Sparky-Eltos' AD are programmers who are in charge of maintaining the ERP system and constantly adapting it to the production process. They also compile SQL queries for various reports and analyses.

Another major fact to consider is that **profits and gains cannot always be measured in money**. The 'time' factor is extremely important, too. The IT department in the company contributes to the automation of a number of business processes and the prevention of various problems, thus saving the company a lot of time, which could be used for other operations and activities.

The highest costs incurred for the maintenance of the data centre are undoubtedly those for electricity consumption, since electricity is used to both power the components and maintain the cooling systems in the server rooms. Clearly, the higher the number of the server rooms, the more difficult it is to maintain the optimum temperature in those rooms. In addition, air conditioners have a fixed service life when used constantly.

The findings of the analysis of the electricity costs, which are mainly incurred by 'Sparky-Eltos' AD for the maintenance of the server rooms (i.e. the data centre), are presented in the table below (See Table 2)[4]:

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[4] In the case of large enterprises, backup power supply from at least two substations is mandatory. According to the contract signed with the electricity distribution company, in case of a power outage, should the power supply from one of the substations fail to be resumed within fifteem minutes, power supply from the backup substation is ensured. UPS devices are therefore designed to provide battery backup power for a maximum of forty minutes. In case of more serious power disturbances, the entire production process stops after that period has expired. The operation of the IT systems that support the production process is also discontinued, while basic system settings ensure that their operation starts automatically and the required condition of the systems is restored after the power supply to the enterprise has been resumed.

Table 2.
Electriity consumption of the enterprise (in KW/h) for maintaining its own data centre

No.	Component	Electricity consumption per hour
1.	Server cabinet – 1	8 KW
2.	Server cabinet – 2	5 KW
3.	UPS (Upper Power System) devices which provide battery backup power during outages	21 KW
4.	Air-conditioning	8 KW

The electricity consumed to maintain the company's own data centre, the servers and the cooling systems working around the clock, is calculated as follows:

42 KW (total consumption per hour) x 24 hours = 1008 KWh per day;
1008 KWh x 0.1461 (BGN) = 147.27 BGN per day[5];
147.27 (BGN) x 30.42 days (the average month) = BGN 4,479.95 monthly costs of electricity consumed for the company's own data center

Since there are 11 physical servers, the cost of replacing the machines in the data centre will be calculated in the following manner:

The total cost for eleven servers at an average unit price of BGN 9,500[6] will equal BGN 104,500 for a period of two years[7], which is BGN 52,250 per year or BGN 4,354 per month.

The gross monthly salary of an IT specialist (we have employed approximate data due to the confidential nature of such information) is about BGN 1,200.

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[5] At the time the research was being conducted (i.e. in 2017 and 2018), the company was an EVN subscriber and paid BGN 0.08250 per KWh. The company also paid an excise duty in compliance with Article 20 of the Excise Duties and Tax Warehouse Act (BGN 0.00200 per KWh) and a price for 'public service obligations' based on their actual energy consumption (BGN 0.03725 per KWh). The end price of a KWh of electricity thus equaled BGN 0.12175 (VAT not included), or BGN 0.1461 (VAT included).

[6] Based on average prices at the time (i.e. in 2017), namely, from BGN 5,000 to BGN 6,000 for custom-built servers and from BGN 12,000 to BGN 15,000 for branded servers. The arithmetic mean of the two prices then equals BGN 9,500, which is the amount we will assume to be the average cost of purchasing a new server.

[7] Each entity determines the depreciation rate it will employ for its equipment. The depreciation rate fixed by 'Sparky Eltos' AD is 2 years.

Software subscription fees are another substantial cost item. The amounts that the company pays annually for major software products and systems are presented in Table 3:

Table 3.
Major monthly software costs[8]

Software	Annual subscription (in BGN)
Oracle database and licence fee for the ERP II system	20,000
VMware server virtualisation	1,500
CAD-CAM system	7,000
Pro/Engineer	8,000
TOTAL:	**36,500**

Data centre maintenance costs are presented in the table below[9]:

Table 4.
Costs incurred by the enterprise for maintaining its own on-site data center

Types of costs incurred by 'Sparky-Eltos' AD for maintaining its own data center	Approximate monthly costs (in BGN)
Electricity consumption (power and cooling) [10]	4,500
Staff (salaries + insurance contributions ≈ 25%)	10,500
Software (subscription fees) + updating the ERP system every 4 years	3,800
Hardware	4,500
Internet	200
External maintenance subscription	300
Purchase of cables, couplings, connecting elements and the physical maintenance of the premise	500
TOTAL:	**24,300**

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[8] These are approximate values due to the confidential character of related information.

[9] These are rough estimates due to the confidential nature of corporate information.

[10] We use round numbers in our estimates since sums below BGN 100 are not substantial to large entreprises.

'Organisations rely on new technologies, innovative management concepts and their efficient utilization in order to gain competitive advantages' (Emilova, P., 2013). Large enterprises in Bulgaria should therefore research the possibility to implement different solutions that would make their performance more cost and time efficient.

4. Development of Information Infrastructure

The development of an information infrastructure in terms of its functions and efficiency depends on the introduction of new technologies and innovative business and organizational models. In terms of architecture, the future development of the information infrastructure in large Bulgarian enterprises will depend on the introduction of technologies such as cloud computing, big data processing, the Internet of Things, the BYOD concept, etc.

Cloud computing has been one of the most dramatic innovations in computer processing over the last years. It offers a mew business model for on-demand delivery of hardware and software resources via the Internet and therefore significantly alters the architecture of an information infrastructure.

The deployment of those technologies will affect two major aspects of corporate performance - it will reduce costs and generate or increase profits. Some of the most significant benefits from the adoption of these technologies are: information infrastructure components will become retail-sale items, whose pricing model is similar to the sale of utility services; companies (mainly entities providing services) will be able to achieve economies of scale at a relatively steady utilization of their capacity; information infrastructure costs will transform from capital expenditure into operating costs; short-term total costs will decline; new business opportunities will appear; the risk and the liability related to one of the most crucial tasks of management, that is, the precise planning of IT resources, will be assigned to delieverers of cloud services; the flexibility of businesses will increase, which will have a direct impact in their competitiveness; the adoption of innovations will be facilitated and encouraged, etc.

Big Data

There are 2.5 quintillion bytes of data created every day, 90 percent of the data generated over the last two years alone (Marr, 2018). The amount of data we produce will continue to grow due to the massive use of cell phones, social networks, touch devices, surveillance cameras, RFID tags, digital photos and videos.

Big Data is a concept of searching, processing and storing data that is characterised by increasingly growing volumes, velocity (the speed at which data is generated, processed and analysed) and variety (types of data) (Laan, 2017). New infrastructure solutions are required to meet the challenges posed by big data. Those include high-speed networks, fast-processing nodes, specialized repositories, etc. Hadoop and Apache Spark, for example, are an open-source software framework that provides massive storage for any kind of data, enormous processing power and the ability to handle virtually limitless concurrent tasks or jobs on computer clusters.

Internet of Things (IoT)

The IoT concept refers to the use of Internet to connect to a huge variety of sensors, devices and equipment. It is powered by the development of numerous connected smart devices, such as home appliances (smart television sets, thermostats, smart security systems, etc.), connected vehicles, medical and industrial equipment (in the manufacturing, energy, transport, etc. sectors). Connected devices have specialised software installed, which enables them to communicate and exchange data. Each device is uniquely recognizable and can operate as part of the existing internet infrastructure. The projected number of devices that will be part of the IoT in 2020 is nearly 30 bln (Internet of Things (IoT), 2018).

Edge computing allows data generated through the IoT to be processed closer to applications, devices and users, instead of sending them to data centres or the cloud. The technology involves multiple units and is a balanced solution for using web-based applications. The major components of the application are processed on less expensive servers, which are near the user, thus eliminating lag time and reducing technological costs.

Conclusion

The digital transformation of business renders information infrastructures an essential resource for enteprises. An information infratsructure must ensure continuous and secure access to the information resources of entities and provide efficient services to users.

Technologies like cloud computing, big data processing, the internet of things, etc. have the potential to change the information infrastructure of organisations so as to raise their performance, to offer new opportunities, to adopt innovations, etc. Data about 'Sparky Eltos' AD in Lovech, as well as computations about changes in the economic efficiency of enterprises in result of transfering some of their information infrastructure onto a cloud[11], equip enterprises with the alternative to store their data on a cloud and thus reduce their costs for maintaining their own data centre.

An option that would reduce the workload of the IT Department in the company in terms of setting up and reprogramming external software solutions (ERP, CRM, HRM) would be to outsource these tasks to the companies that produce or introduce the product.

For large enterprises with less intensive personalization of parameters, an adequate solution would be to use the SaaS (Software as a Service) distribution model, which offers greater flexibility and instant access to its latest versions. Specialists also emphasise the fact that companies that insist on using the desktop versions of their programmes need to wait three months longer to have a new version installed and set up than they would if they chose the SaaS model (Handova).

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[11] These computations have been described in detail in Teodora Spasova's PhD dissertation paper 'Migratsiya na informatsionnata infrastruktura na golyamo predpriyatie v Balgariya kam oblaka'.

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    Address: "D. A. Tsenov" Academy of Economics, 2, Em. Chakarov Str., Svishtov, Bulgaria