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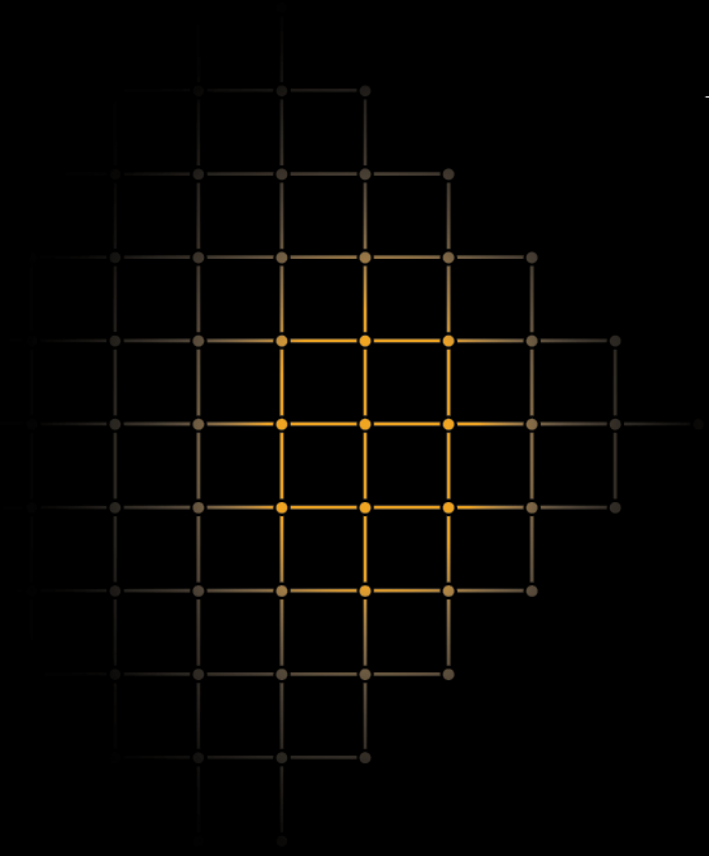
TADEUSZ GRABIŃSKI



Social importance of information systems

IN MANAGEMENT

KRAKÓW 2020

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SOCIETAS VISTULANA

KRAKÓW 2020

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Table of contents

Introduction

We are pleased to present a monograph addressing key issues in contemporary management – information systems. Nowadays, many organizations face challenges of digital transformation and analysis of the large databases containing billions of records become the necessity of the day and the key factor of success. Organizations not able to cope with the digital world become obsolete and melt away. The publication invokes various aspects of the social importance of information within different organizations.

The following issues resound in the monograph: how to exploit Business Intelligent class systems into the efficient management system for decision-making. A key factor in the competitiveness of modern organizations is the ability to transform business data, both in operational and strategic terms, into decision-making knowledge. It is an extremely complex process from the perspective of both the selection of variables, optimization formulas and the quality of data obtained to perform a reliable analysis and diagnosis. Another completely different issue is selecting, acquiring, and implementing technological solutions and providing adequate "know-how" in managing such a project, which significantly affects the outcome. The crucial question is to what extent can modern organizations, regardless of the scale of their activity or sector affiliation, use modern system solutions, with particular emphasis on Business Intelligence solutions, in terms of supporting the process of efficient decision making? The first part of the publication covers the characteristics of BI solutions in the context of knowledge management; analysis of the conditions in the selection of the system and supplier; comments on the implementation methodology of the BI class system, usability assessment of the above solutions, including a description of the advantages and disadvantages of "on-premise" applications, as well as the so-called "Cloud technologies". The Authors employ the SAP Analytics Cloud system to illustrate BI solutions in the data processing.

The second chapter refers to the very broad problem of the materiality and relevance of the information. In today's online world, there is much more data to be processed and accessible to different parties like entrepreneurs, managers or clients. Companies have never had so much information at their disposal. When segmenting consumer data (cookies), online habits can be read by checking the pages they visit, the information they stop at, and the products they are seeking. It's easy to find anything online because everyone can create and load data on the Internet. In turn, it shapes the environment in which companies can carefully select and adapt the message to a specific user to be as convincing as possible. All our movements leave a trace on the web, which is later used to define our behaviour, likes, preferences, etc. The second chapter presents the aspect of the possibility of collecting information cookies, as well as the Internet media used in marketing activities. It shows what information can be read from the visited pages and how data analysis supports the decision-making process. Last but not least, it also addresses the issue of the current state of website privacy protection.

The next chapter brings closer the problem of museum e-shop. This part presents a qualitative research method on online museum stores on the example of 30 Polish museums with the highest attendance in 2017. The study showed that not all museums have online stores in the online version, and the biggest problem is the low percentage of e-stores enabling electronic payments. The problem is carried forward by the analysis of the usability of museum websites.

Another issue invoked in the monograph is the e-learning technique. For example, how simulating programs, knowledge pills, or gamification can enrich the learning experience. Each of these methods is or may be used in education, and each has its advantages and drawbacks. The publication put special emphasis on knowledge pills, which are a relatively new, fast and effective way of communicating small but properly selected pieces of knowledge on a given topic. Due to the method of knowledge sharing is delivered when it is most needed. The last chapter presents considerations on the possibility of using knowledge pills as tools supporting the management of knowledge transfer with the use of materials developed in this form. It also shows the research results on knowledge pills carried out among students of senior high school years.

We trust that our publication will attract all readers interested in management, education and computer science. Passionate Authors prepared the monograph, and we do hope that the monograph will be able to infect readers with this passion.

Editor

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BI class systems and efficient management decision-making

Abstract

The key competitive indicator of contemporary organizations is the skill to transfer raw business data, both on the operational and strategic level, into decision knowledge. We have to remember that this process is extremely complicated, taking into consideration the difficulties of choosing the right ratios, optimizations formulas and the quality of data needed to perform reliable analysis. Quite different issue is related to the skill of choosing and purchasing the most appropriate information technology and assuring the needed know-how in the area of the BI Project Management. The main question of this article is: What is the level of usefulness for the contemporary organizations to implement BI software solutions to support their the decision process, in spite of the industry or the size of the business.

The article consists of: 1) BI systems characteristics; 2) Analysis of the BI system and the implementation partner determination process; 3) BI systems efficiency analysis (on premise vs cloud computing); 4) BI implementation methodology and 5) case study performed with the support of SAP Analytics Cloud system. To answer all the questions, "Analysis-Synthesis" and "Simulation Modelling" methods were adapted.

Introduction

A key factor in the competitiveness of modern organizations is the ability to transform business data into decision-making knowledge, both in operational and strategic terms. However, we must remember that it is an extremely complex process from the point of view of both the selection of variables, optimization formulas and the quality of data obtained in order to perform a reliable analysis and diagnosis. Another completely different issue is the ability to choose, purchase and implement technological solutions as well as to provide adequate "know-how" in the management of such a project, which significantly affects the success or failure of this type of undertaking. However, the question arises: To what extent can contemporary organizations, regardless of the scale of their activity, the industry or sector of economy represented, use modern system solutions, with particular emphasis on Business Intelligence solutions, in terms of supporting the process of efficient decision making?

The study covers: the characteristics of BI solutions in the context of knowledge management; analysis of the conditions in the selection of the system and supplier; comments on the implementation methodology of the BI class system, usability assessment of the above solutions, including a description of the advantages and disadvantages of "on-premise" applications, as well as the so-called "Cloud technologies". The SAP Analytics Cloud system will be used as an illustration of BI solutions in the field of data processing.

In order to answer the questions posed, the analytical and synthetic method was used, as well as simulation modelling carried out with BI software SAP Analytics Cloud.

1. Characteristics of Business Intelligence solutions and knowledge management

In 2003, Gartner defined "Business Intelligence" as "a user-oriented process of collecting, exploring, interpreting and analysing data, which leads to the improvement and rationalization of the decision-making process. These systems support

the managerial staff in making business decisions in order to create an increase in the company's value"[1]. After a dozen or so years, a number of modifications were made to the understanding of this concept. Currently, on the Gartner website in IT Glossary, we have the following definition: "*Business Intelligence* (BI) is a general term encompassing applications, infrastructure and tools, and best practices, that enable information to be accessed and analysed to improve and optimize decisions and performance"[2].

Reflecting on the theoretical and technological foundations, we will reach for such disciplines as:

- Statistics and econometrics,
- Operational research,
- Artificial intelligence,
- Database technologies, including data warehouses.

In turn, Surma[3] distinguishes the following categories of technologies in BI class decision support systems:

- OLAP tools (On-Line Analytical Processing)
- data mining tools,
- knowledge management tools.

Currently, these technologies have gained a new dimension through In Memory Computing technologies (e.g. SAP HANA) and cloud computing.

In the first part of the definition, an important element is the transformation of information into knowledge necessary to make decisions ensuring the company's competitiveness. The problem is that, as Olszak points out[4],

- knowledge is located in many places,
- knowledge is often informal,
- there is an unclear division into public and private knowledge,
- a wealth of knowledge is obtained interactively and shared in subgroups or networks,
- knowledge consists of many types and carriers.

---

1 J. Surma, *Business Intelligence. Systemy wspomagania decyzji biznesowych*, Wydawnictwo Naukowe PWN, Warszawa 2009, p. 13.

2 https://www.gartner.com/it-glossary/business-intelligence-bi/ (accessed on May 21, 2019).

3 J. Surma, *Business Intelligence*, p. 13.

4 C.M. Olszak, *Tworzenie i wykorzystanie systemów Business Intelligence na potrzeby współczesnej organizacji*, Wydawnictwo Akademii Ekonomicznej w Katowicach, Katowice 2007, p. 19.

So how to deal with gathering knowledge in a single decision support system? How to provide information that can be transformed into knowledge?

Olszak[5] presents the most important methods that may be helpful in the development of IT decision-making systems, in the form of a tree as in Figure 1.

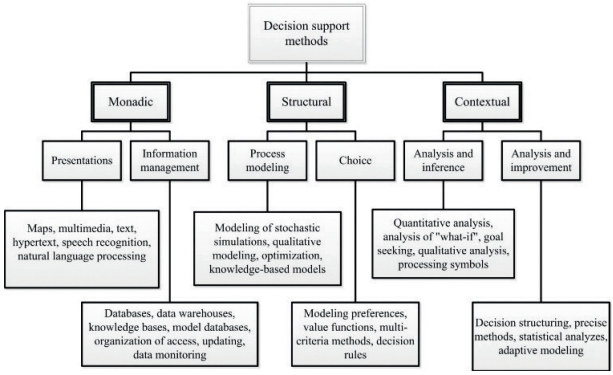

Figure 1. Methods helpful in the development of IT decision-making systems.
Source: C.M. Olszak, *Tworzenie i wykorzystanie systemów Business Intelligence*.

According to Olszak[6], BI systems integrate the best features of various decision support methods indicate the following characteristics of such systems through the following features:

- types of problems – structured, partially structured and unstructured,
- tasks – exploration and knowledge acquisition,
- time horizon – present, future,
- decision-making area – operational, tactical, strategic,
- technology – data warehouse, OLAP, data mining,
- typical applications – market and financial analyses, anomaly detection,
- users – decision makers at all levels of management, analysts, customers, stakeholders.

Based on the definition of BI quoted after Gartner IT Glossary, we can associate the classic sequence of data-into-knowledge transformation with the classes of management support systems, as shown in Figure 2.

5 Ibid., p. 33.

6 Ibid., p. 70.

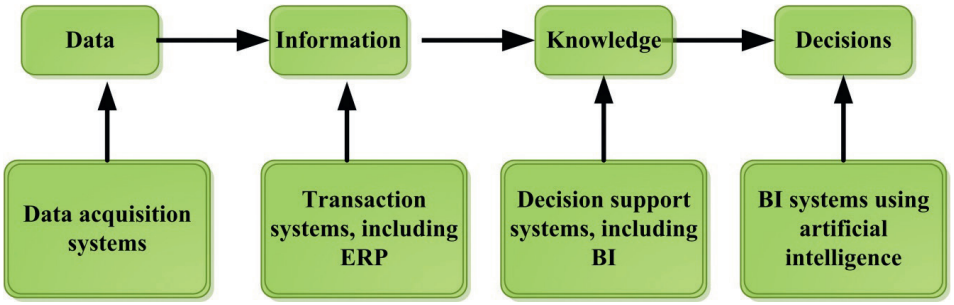

Figure 2. Linking the sequence of converting data into knowledge with the classes of management support systems.

Source: Author's own work.

To sum up, business knowledge management is always the process of transforming data obtained from various sources, including, above all, ERP class systems, into knowledge that determines making optimal decisions. This is what BI class programs are for. Therefore, it should be emphasized that the term Business Intelligence (BI) "is not an information technology but a vision of the functioning of the information system in the enterprise"[7]. BI is primarily a way to efficiently manage a company, not just a set of often extremely attractive charts or management dashboards.

2. Analysis of the conditions for choosing a BI class system and supplier

The decision to implement BI software as an element of the information and decision-making system leads directly to the dilemma of choosing the program, IT technology and the implementation service provider itself.

Based on the research (2,500 questionnaires) carried out by BARC (Business Application Research Center), 3 most important aspects related to the defined needs and preferences of BI class system users were indicated. They are: 1) Functional (analytical) capabilities of the system (51% of responses); 2) Proper relation of the software price to its efficiency (40%); and 3) Ease and user-friendliness of reporting for system users (37%). The least important ones include: good relationship with

[7] R. Sierocki, *Warunki skutecznego wdrożenia systemu Business Intelligence*, www.bi-pro.pl (accessed on May 30, 2019).

the supplier (only 6%), additional options/functions that can be used in working with the system (5%), international character of the solution (5%)[8].

Figure 3. BI software selection criteria.

Source: https://bi-survey.com (accessed on May 30, 2019).

The choice of the company that implements our BI system should be independent of the choice of the software itself, although often this assumption is not feasible in business practice. Nevertheless, it is a choice that largely influences harmonious cooperation and ultimately a positive end result of the design work. The most important are[9]:

1. Experience gained in the implementation of BI projects understood not so much as the number of implemented implementations, but rather the quality and complexity of the functionalities launched;
2. Substantive opinions of customers and BI system users obtained as a result of the study visits;
3. Quality and number of consultants available in the project, including experienced and highly rated subcontractors in the industry;

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8 Business Application Research Center, *BI Survey Report*, https://bi-survey.com (accessed on May 30, 2019).

9 G. Grupiński, *Pięć najczęściej wymienianych zagadnień, na które należy zwrócić uwagę przy wyborze firmy*, Akademia Wiedzy BCC, www.bcc.com.pl/akademia (accessed on May 30, 2019).

4. Possibility of comprehensive project management, including efficient coordination of works carried out by subcontractors;
5. Substantive knowledge in the field of business, industry and legal issues of consultants and subcontractors.

However, it should be remembered that the de facto success of the BI venture will not ultimately be determined by the choice of one program or another, but rather the selection of a reliable implementation service provider, including the right project methodology.

3. BI class system implementation project — methodological conditions

The implementation of each project, including the BI class system implementation project, requires the use of an efficient methodology, understood as 1) System (software) installation; 2) Program launch and technical verification; 3) Checking the system or solution for functionality; and 4) Handover the system to the user for productive operation[10].

From the perspective of managing this type of project at the operational level, we can distinguish the following activities[11]:

1. Development by the contracting authority of a global strategic information system of the enterprise – definition of information needs and usefulness;
2. Development of a detailed concept by the implementation company: data qualification, identification of sources, homogenization and correlation of data, data storage, presentation and analysis of reports/indicators/trends, etc., selection of technology and contractor;
3. Preparation of a prototype solution, simulation of reports, variants;
4. Testing the prototype solution, submitting comments;
5. Final acceptance of the solution and productive start;
6. Monitoring the degree of use of a new BI solution in the company's decision-making processes;
7. Searching for new needs, information opportunities within SIS – proposition of changes or BI development.

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10 Instytut Zarządzania, *Raport oprogramowania biznesowego*, Warszawa 2001, p. 18.

11 It should be remembered that in the industry literature there is a whole set of different approaches and division into individual phases or tasks. To a large extent, the system implementation service provider will decide on the choice of the preferred methodology. See M. Flasiński, *Zarządzanie projektami informatycznymi*, Wydawnictwo Naukowe PWN, Warszawa 2006, pp. 69–77.

The key determinant of the success or failure of this type of project is undoubtedly the definition of the real information needs of individual groups of decision-makers and stakeholders from the perspective of the decisions made, both at the operational and strategic levels. Unfortunately, this task is the greatest challenge for the contracting authority. It often requires him to redefine the entire information and decision-making process, including learning the latest technological solutions. The quality of the business concept in terms of developing a new management model will ultimately determine the usefulness of this type of solution, regardless of the degree of modernity of the implemented IT technology.

4. Assessment of the usefulness of the above solutions, including a description of the advantages and disadvantages of "on-premise" applications, as well as the so-called "Cloud technologies"

Changes and technological innovations determine yet another choice dilemma faced by management boards of modern companies. One example is the choice between "on-premise" solutions (the software is installed on the customer's infrastructure) and the "cloud" technology (the so-called virtual cloud of services available to the customer) enabling access to a whole range of "online" services using software and external infrastructure. We can point out the following strengths and weaknesses of these two solutions:

Table 1. "On-premise" type solutions.

ADVANTAGES	DISADVANTAGES
Full control over information resources	Full responsibility for possessed information resources (compliance with GDPR)
Faster access to data, function resources	Higher total cost of maintaining and developing systems and infrastructure
Full control over license agreements and the scope of cooperation with system suppliers	Lack of full mobility in terms of access to data, resources, functions — local access
Full adjustment of the system to the customer's needs — a full range of customization and configuration.	A limited range of services, functions, including innovative solutions available only in the cloud.
Guarantee of uninterrupted access to functions, services and resources	Longer time to start the solution — system implementation

Source: own study based on: A. Krawiec, *ERP w chmurze czy on-premise? Wybór nie jest oczywisty*, "Computerworld", www.computerworld.pl (accessed on May 30, 2019).

Table 2. Cloud solutions.

ADVANTAGES	DISADVANTAGES
Data protection risk transfer (GDPR, ZBZI)	Lack of full control over information resources
Lower total cost of maintaining and developing systems and infrastructure	Slower access to data, resources and functions
Full mobility in terms of access to data, resources, functions – local access	Unpredictability in terms of license agreements, costs, scope of cooperation
Wide range of services, functions, etc.	Necessity to use preconfigured solutions – minimal scope of customization
Relatively fast time to launch the solution – system implementation	Guarantee of uninterrupted access to functions, services and resources
Access to innovative solutions	Need to provide a fast and reliable internet connection

Source: A. Krawiec, *ERP w chmurze czy on-premise?*

Taking into account the advantages and disadvantages of both technologies, one of the possible options is to implement a hybrid solution whose functional modules operate partly "on-premise" in the client's infrastructure, and in part in an externally purchased private, public cloud or in hosting[12]. Such a strategy enables the development of an optimal model in terms of ensuring the sustainable development of each company.

5. SAP Analytics Cloud as an example of a BI solution in the field of business data processing

Cloud computing and storage has been gaining in importance in recent years and is used both for business and private purposes. However, entrepreneurs approach this type of solutions with particular caution. While most of them use client-server solutions, they are wary of cloud-based storage and use of the management system and data. One of the models of using cloud computing is remote access to applications via a web browser – Software-as-a-Service (SaaS). In order to increase the level of trust in this solution, providers use the most modern methods of ensuring the security and confidentiality of data and transmission when accessing the application. SAP AG (Systemanalyse und Programmentwicklung AG, headquarters Walldorf, Germany) has developed its own SaaS BI solution under the name SAP Analytics-Cloud (SAC). The above BI solution is the only commercially available solution

[12] S. Jagiełło, *Hybrydowe ERP – czy to się opłaca?*, blog.macrologic.pl (accessed on November 24, 2015).

that combines three possibilities: analytical: reporting, planning and prediction[13]. The system located in the cloud ensures fast data processing and visualization of the result. The transmission speed and the device on which the web browser is running are important. SAC allows you to connect various data sources, not only cloud ones. The user can select the reporting method depending on the type of device: stationary or portable. Another advantage is access from anywhere with internet access. Figure 4 shows a diagram of the connection to data sources and the use of SAC.

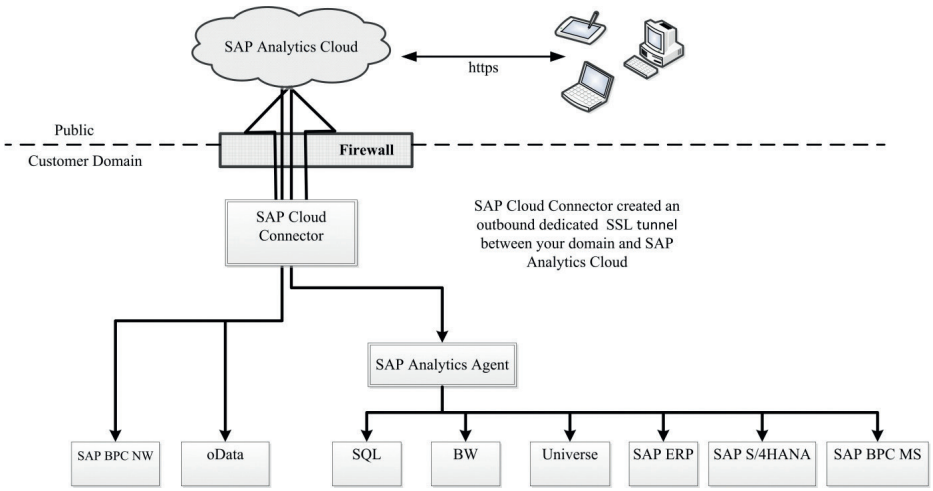

Figure 4. Data sources and use of SAC.

Source: based on B. Woźniak, *Odkrywanie biznesu w chmurze.*

Using the SAP Analytics Cloud (SAC) system, we analysed three elements of the financial statements of three listed companies: Orbis S.A., Quantum Software S.A. and Stalexport Autostrady S.A. All predictive methods available in SAC were used, enabling forecasting for subsequent periods. The SAC system uses three methods for predicting the results: linear regression, triple exponential smoothing[14] and automatic scheduling. Automatic scheduling selects the forecast method according to the manufacturer's algorithm. There is no room here for a broader discussion of the mathematical basis of methods.

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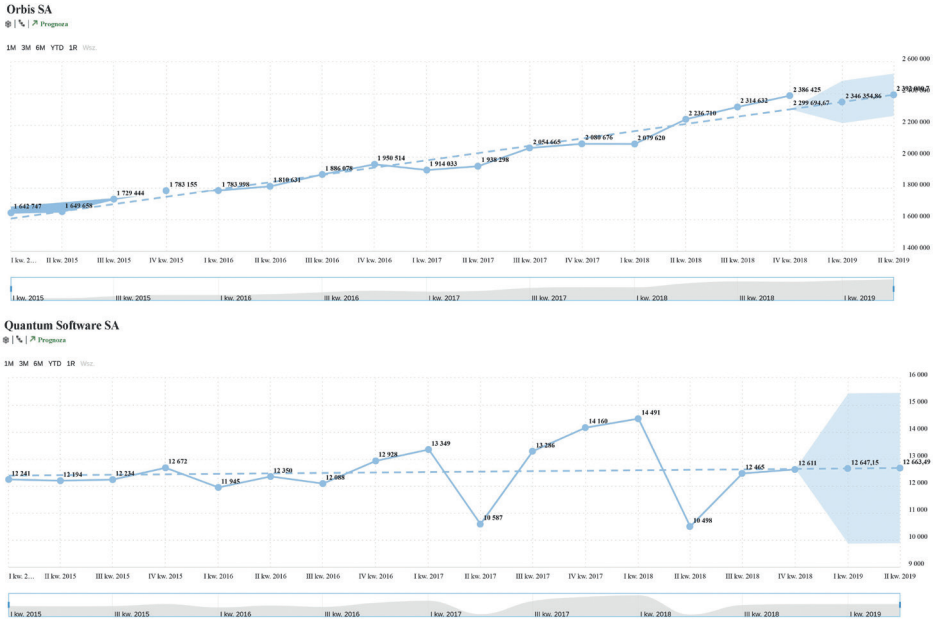
13 In the article by B. Woźniak, *Odkrywanie biznesu w chmurze. Analityka z SAP Analytics Cloud*, "Lepszy Biznes, SNP Poland", 4 (72), December 2018, there is a comparison with other similar SAP systems and information on ensuring security.

14 This method is called in the literature the Winters multiplicative method, which can be used in the case of time series containing a development tendency, seasonal fluctuations and random fluctuations, http: //www.econometria.4me.pl/metoda-wintersa.htm (accessed on May 31, 2019).

We will successively present the results of the analysis[15]. First, the results obtained in the SAC system will be presented[16] in the form of graphs, then a table collecting the results of calculations, and then the conclusions will be discussed[17].

5.1. Equity capital

Equity capital - Linear Regression



15 For a comparative analysis of forecasting methods, see K. Halicka, C. Winkowski, *The use of exponential smoothing methods to forecast the EUR selling rate*, http://yadda.icm.edu.pl/baztech/element/bwmeta1.element.baztech-dfd3932f-e56c-4ae0-9df5-31bf54514757 (accessed on May 31, 2019).

16 SAC was used in the SAP Analytics Cloud for Higher Education version with the "Academic Account" license. Academic Account includes complete business analysis, planning, predictive analytics and SAP Digital Boardroom functionality in a collaborative learning environment.

17 Data for analysis was obtained from Reports of listed companies: Money.pl, *Raporty spółek giełdowych*, https://www.money.pl/gielda/raporty (accessed on May 10, 2019).

Figure 5. Equity, method: linear regression. SAC system report source.

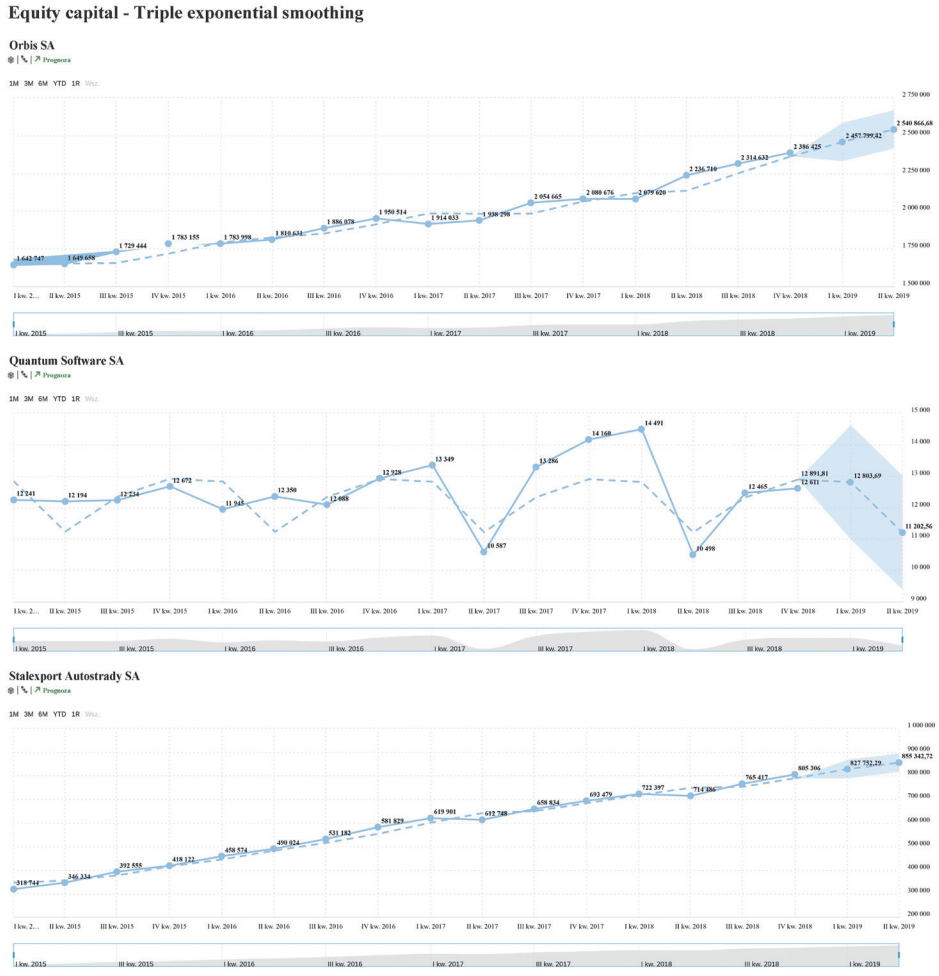


Figure 6. Equity capital, method: triple exponential smoothing. SAC system report source.

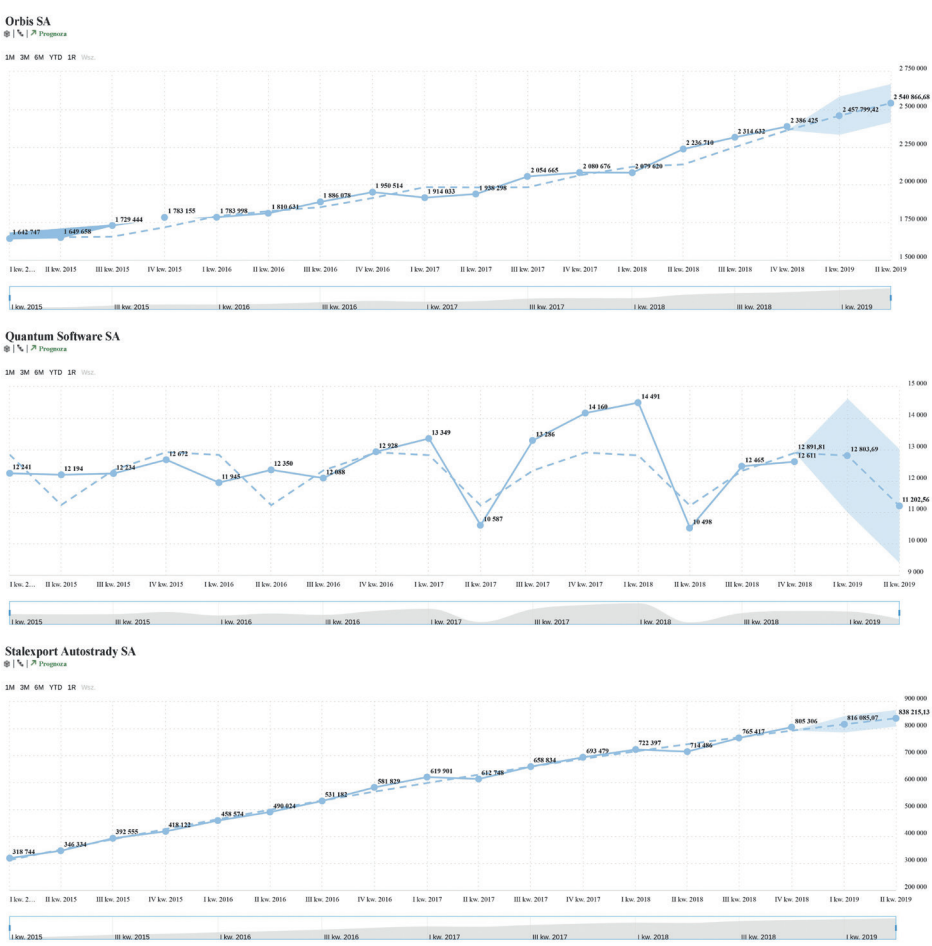


Figure 7. Equity capital, method: automatic planning. SAC system report source.

Table 3. Statement of the value of equity forecasts based on data from the SAC system.

Equity capital				
Linear regression				
		ORBIS S.A.	Quantum Software S.A.	Stalexport Autostrady S.A.
K4 2018 source		2,386,425.00	12,611.00	805,306.00
K4 2018 calculated		2,222,562.46	12,772.57	812,294.83
difference	value	-163,862.54	161.57	6,988.83
	%	-6.87	1.28	0.87
K1 2019 calculated		2,261,890.55	12,817.52	845,111.89
K1 2019 estimate min	value	2,035,558.90	9,994.30	808,960.10
	%	-10.01	-22.03	-4.28
K1 2019 estimate max	value	2,488,222.20	15,640.74	881,263.68
	%	10.01	22.03	4.28
K2 2019 calculated		2,300,363.68	12,861.50	877,215.55
K2 2019 estimate min	value	2,074,032.03	10,038.28	841,063.75
	%	-9.84	-21.95	-4.12
K2 2019 estimate max	value	2,526,390.53	15,684.72	913,367.32
	%	9.84	21.95	4.12
Triple exponential smoothing				
		ORBIS S.A.	Quantum Software S.A.	Stalexport Autostrady S.A.
K4 2018 source		2,386,425.00	12,611.00	805,306.00
K4 2018 calculated		2,368,104.94	12,877.11	789,083.05
difference	value	-18,320.06	266.11	-16,222.95
	%	-0.77	2.11	-2.01
K1 2019 calculated		2,461,011.70	12,790.23	828,028.12
K1 2019 estimate min	value	2,336,194.32	10,953.38	867,508.24
	%	-5.07	-14.36	4.77
K1 2019 estimate max	value	2,585,829.08	14,627.08	788,549.99
	%	5.07	14.36	-4.77
K2 2019 calculated		2,543,159.61	11,235.22	856 619.12
K2 2019 estimate min	value	2,418,342.23	9,398.37	816 139.99
	%	-4.91	-16.35	-4.73

Equity capital				
Triple exponential smoothing				
		ORBIS S.A.	Quantum Software S.A.	Stalexport Autostrady S.A.
K2 2019 estimate max	value	2 667 976.99	13 072.06	895 098.24
	%	4.91	16.35	4.49
Automatic scheduled				
		ORBIS S.A.	Quantum Software S.A.	Stalexport Autostrady S.A.
K4 2018 source		2,386,425.00	12,611.00	805,306.00
K4 2018 calculated		2,266,910.93	12,465.00	792,977.99
difference	value	-119,514.07	-146.00	-12,328.01
	%	-5.01	-1.16	-1.53
K1 2019 calculated		2,320,173.27	12,611.00	815,149.43
K1 2019 estimate min	value	2,148,554.31	8,234.45	782,785.53
	%	-7.40	-34.70	-3.97
K1 2019 estimate max	value	2,491,792.23	16,987.55	847,513.34
	%	7.40	34.70	3.97
K2 2019 calculated		2,373,985.58	12,611.00	835 457.27
K2 2019 estimate min	value	2,202,366.62	7,867.18	803,093.37
	%	-7.23	-37.62	-3.87
K2 2019 estimate max	value	2,545,604.54	17,354.82	867,821.17
	%	7.23	37.62	3.87

Source: own material.

Table 3 shows the results of the forecast for the change in equity for all firms and methods. For Orbis S.A., the tiniest error in estimating the change in capital is given by the "Triple exponential smoothing" method and in this case can be the basis for making a decision. The best forecast results and the smallest estimation error have been obtained for Stalexport Autostrady S.A. Here, regardless of the forecast method, the decision will be correct. However, in the case of a company Quantum Software S.A., none of the methods gives an error small enough to make decisions based on it.

5.2. Sales revenue

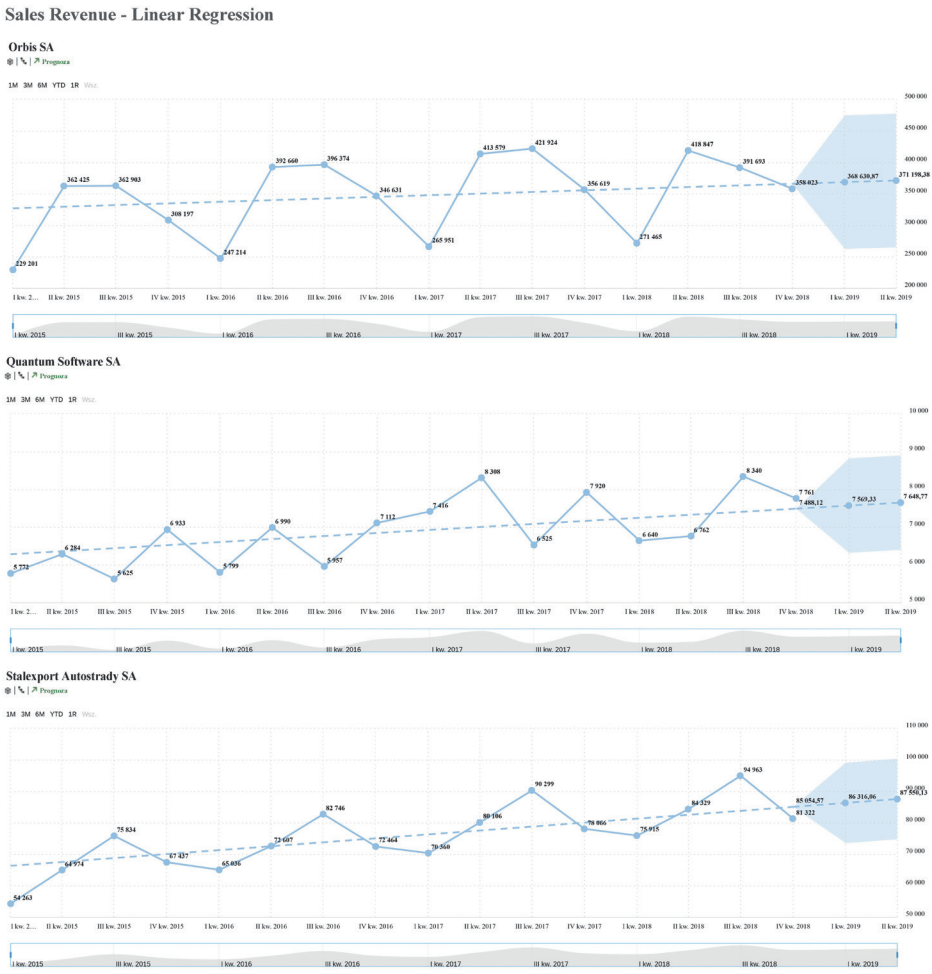


Figure 8. Sales revenue, linear regression method. SAC system report source.

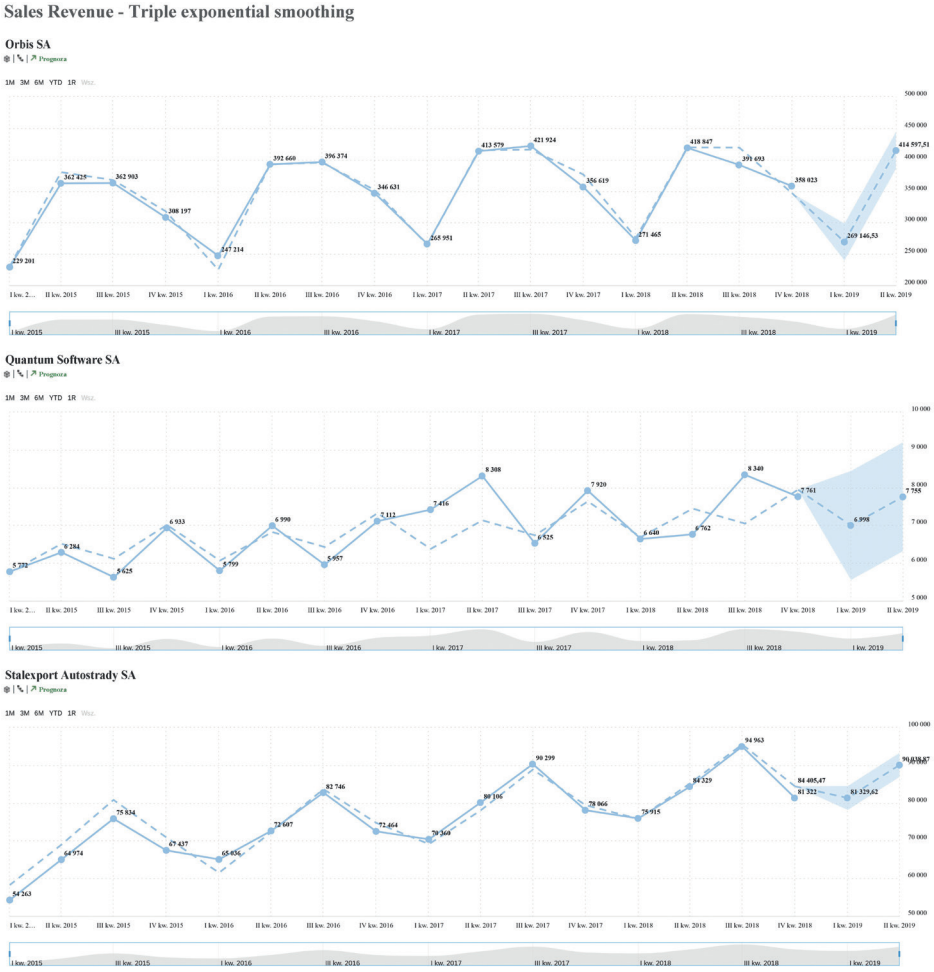


Figure 9. Sales revenue, triple exponential smoothing method. SAC system report source.

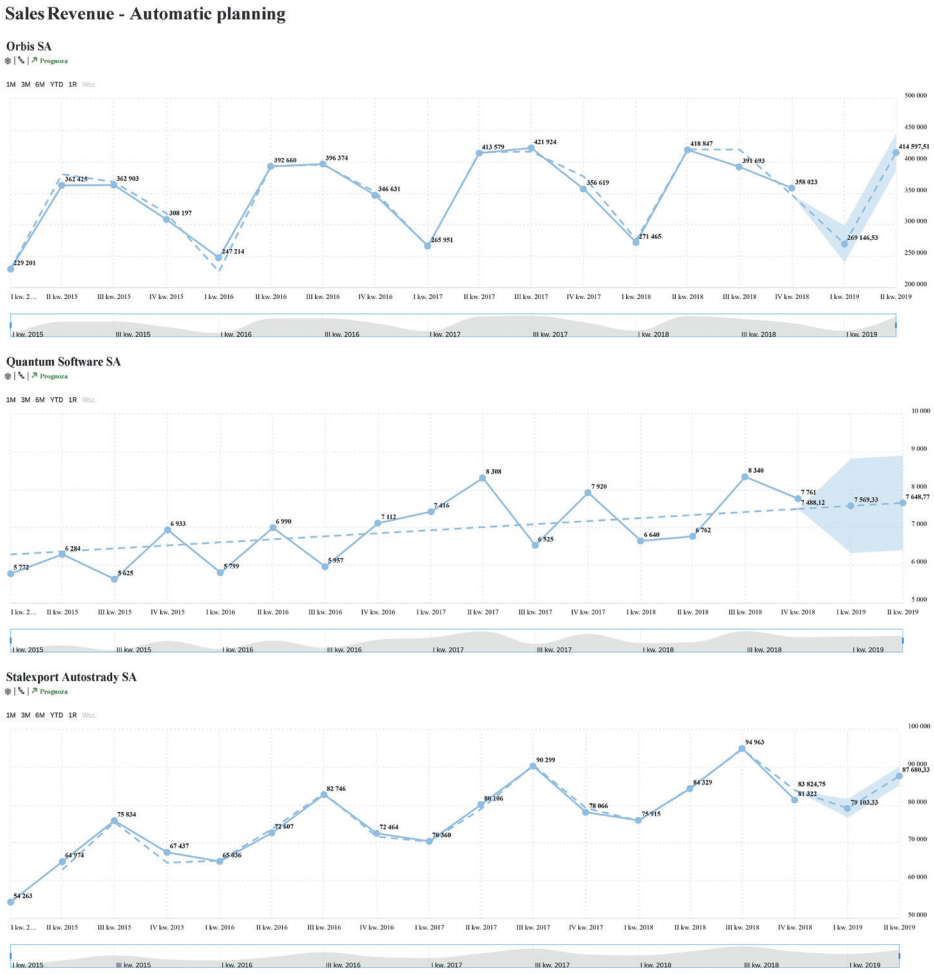


Figure 10. Sales revenue, automatic planning method. SAC system report source.

Table 4. Summary of sales revenue forecasts based on data from the SAC system.

Revenues from sales				
Linear regression				
		ORBIS S.A.	Quantum Software S.A.	Stalexport Autostrady S.A.
K4 2018 source		358,023.00	7,761.00	81,322.00
K4 2018 calculated		367,596.58	7,552.01	85,245.47
difference	value	9,573.58	-208.99	3,923.47
	%	2.67	-2.69	4.82
K1 2019 calculated		371,867.45	7,663.67	86,742.31
K1 2019 estimate min	value	267,089.06	6,458.33	73,990.89
	%	-28.18	-15.73	-14.70
K1 2019 estimate max	value	476,645.84	8,869.01	99,493.73
	%	28.18	15.73	14.70
K2 2019 calculated		376,045.48	7,772.90	88,206.61
K2 2019 estimate min	value	271,267.09	6,567.57	75,455.19
	%	-27.86	-15.51	-14.46
K2 2019 estimate max	value	480,823.87	8,978.34	100,958.03
	%	27.86	15.51	14.46
Triple exponential smoothing				
		ORBIS S.A.	Quantum Software S.A.	Stalexport Autostrady S.A.
K4 2018 source		358,023.00	7,761.00	81,322.00
K4 2018 calculated		341,832.22	8,006.23	789,083.05
difference	value	-16,190.78	245.23	707,761.05
	%	-4.52	3.16	870.32
K1 2019 calculated		256,725.76	6,949.30	828,028.12
K1 2019 estimate min	value	227,395.29	5,458.51	76,700.18
	%	-11.42	-21.45	-90.74
K1 2019 estimate max	value	286,056.23	8,440.09	83,305.82
	%	11.42	21.45	-89.94
K2 2019 calculated		398,589.84	7,781.13	89,305.07
K2 2019 estimate min	value	369,259.37	6,290.34	86,002.25
	%	-7.36	-19.16	-3.70

Revenues from sales				
Triple exponential smoothing				
		ORBIS S.A.	Quantum Software S.A.	Stalexport Autostrady S.A.
K2 2019 estimate max	value	427,920.31	9,271.92	92,607.89
	%	7.36	19.16	3.70
Automatic scheduled				
		ORBIS S.A.	Quantum Software S.A.	Stalexport Autostrady S.A.
K4 2018 source		358,023.00	7,761.00	81,322.00
K4 2018 calculated		366,441.33	7,772.21	84,659.00
difference	value	8,418.33	11.21	3,337.00
	%	2.35	0.14	4.10
K1 2019 calculated		268,637.00	7,883.87	79 069.50
K1 2019 estimate min	value	228,444.39	6,597.01	75,780.78
	%	-14.96	-16.32	-4.16
K1 2019 estimate max	value	308,829.61	9,170.72	82,358.22
	%	14.96	16.32	4.16
K2 2019 calculated		433,728.50	7,993.10	87,728.00
K2 2019 estimate min	value	393,535.89	6,706.25	84,198.32
	%	-9.27	-16.10	-4.02
K2 2019 estimate max	value	473,921.11	9,279.96	91,257.68
	%	9.27	16.10	4.02

Source: own material

Table 4 shows the results of the forecast for the change in sales for all companies and methods. None of the methods works for Quantum Software S.A. For the remaining companies, the results of both triple exponential smoothing and automatic scheduling can be used to make a decision, with the smaller error rate given by the triple exponential smoothing method.

5.3. Book value of 1 share

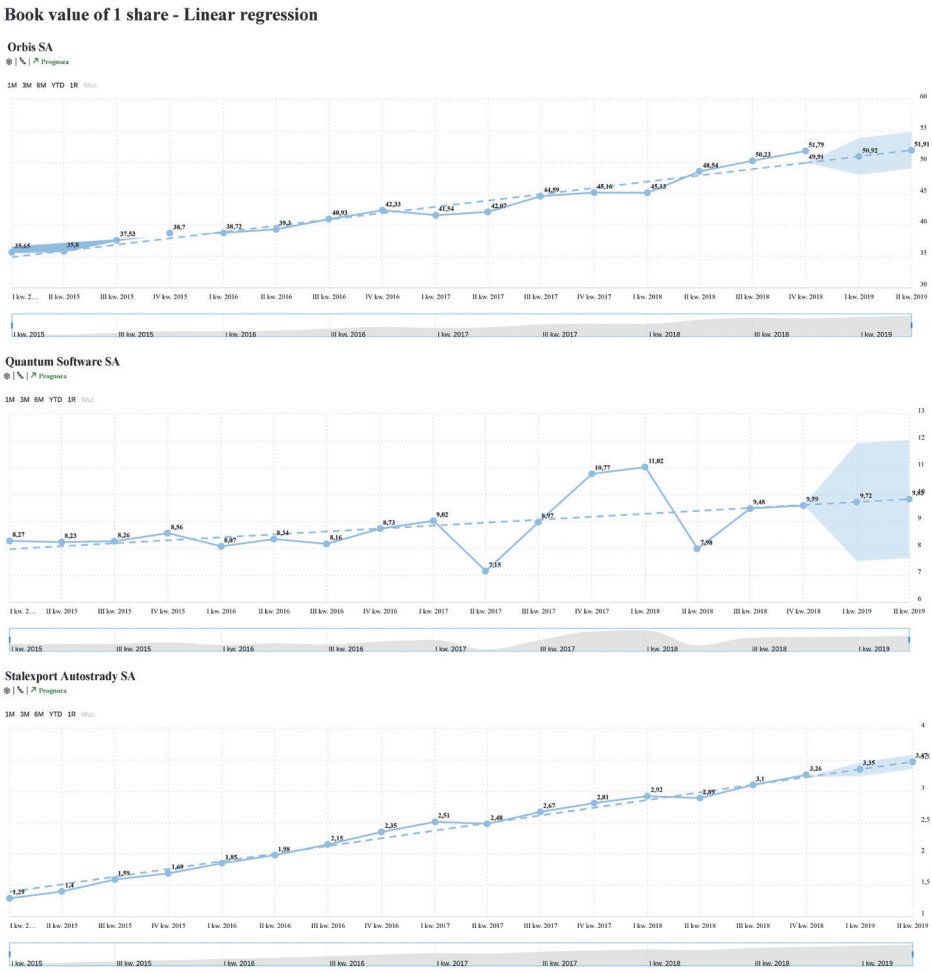


Figure 11. Book value of 1 share, linear regression method. SAC system report source.

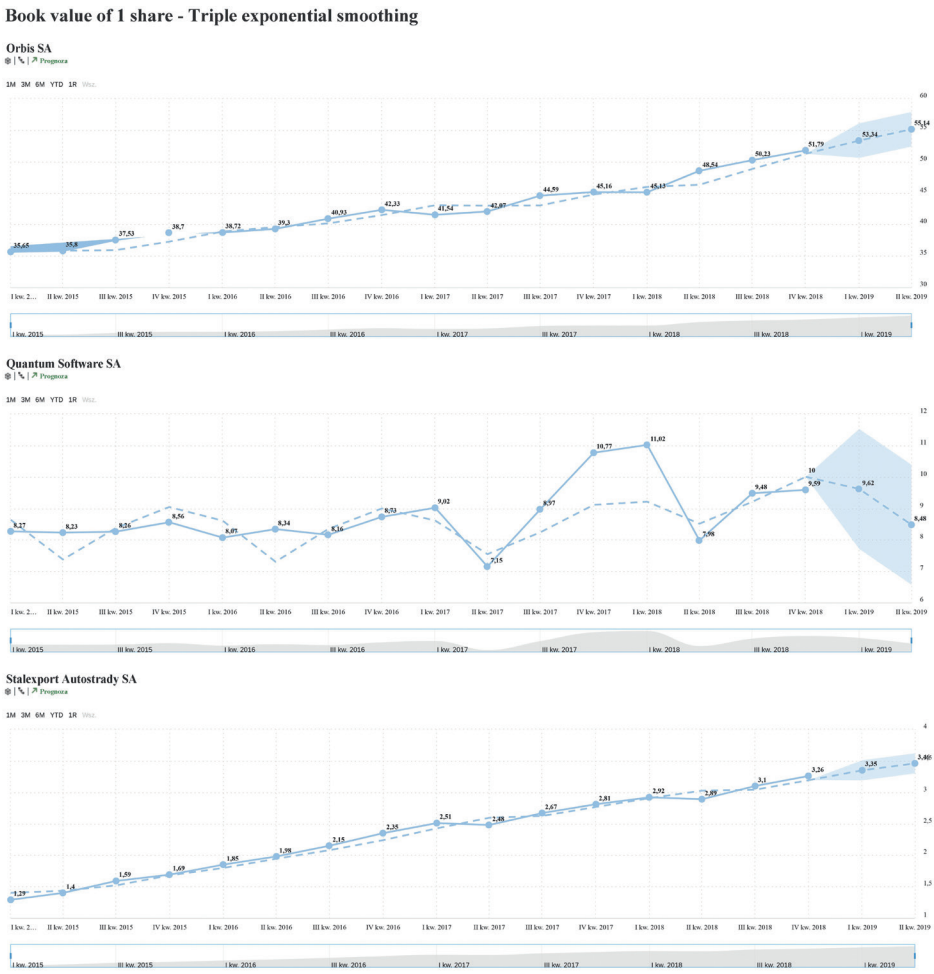


Figure 12. Book value of 1 share, triple exponential smoothing method. SAC system report source.

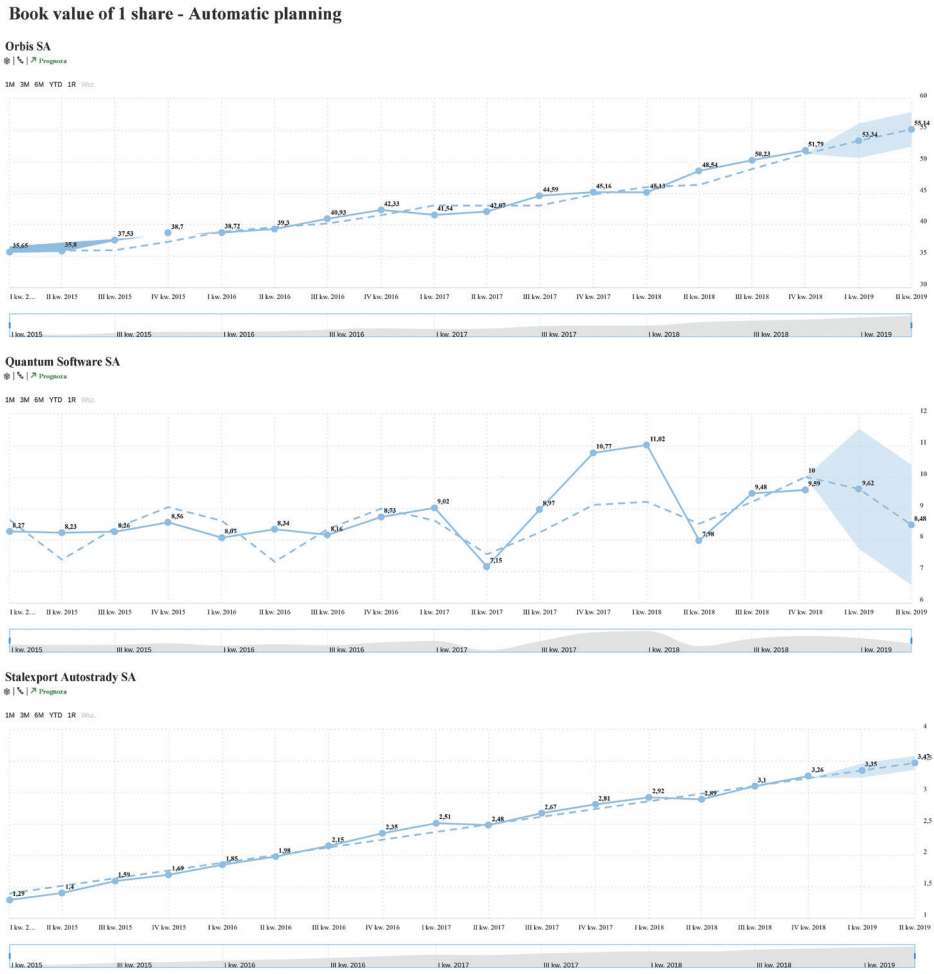


Figure 13. Book value of 1 share automatic scheduling method. SAC system report source.

Table 5. Summary of forecast values book value of 1 share based on data from the SAC system.

Book value of 1 share				
Linear regression				
		ORBIS S.A.	Quantum Software S.A.	Stalexport Autostrady S.A.
K4 2018 source		51.79	9.59	3.26
K4 2018 calculated		48.24	9.56	3.29
difference	value	-3.55	-0.03	0.03
	%	-6.85	-0.31	0.92
K1 2019 calculated		49.09	9.67	3.42
K1 2019 estimate min	value	44.19	7.47	3.27
	%	-9.98	-22.75	-4.39
K1 2019 estimate max	value	54.00	11.86	3.42
	%	10.00	22.65	0.00
K2 2019 calculated		49.93	9.77	3.55
K2 2019 estimate min	value	45.02	7.57	3.40
	%	-9.83	-22.52	-4.23
K2 2019 estimate max	value	54.83	11.97	3.70
	%	9.81	22.52	4.23
Triple exponential smoothing				
		ORBIS S.A.	Quantum Software S.A.	Stalexport Autostrady S.A.
K4 2018 source		51.79	9.59	3.26
K4 2018 calculated		51.39	10.18	3.19
difference	value	-0.40	0.59	-0.07
	%	-0.77	6.15	-2.15
K1 2019 calculated		53.41	9.86	3.35
K1 2019 estimate min	value	50.70	7.81	3.19
	%	-5.07	-20.79	4.78
K1 2019 estimate max	value	56,12	11.91	3.51
	%	5.07	20.79	4.78
K2 2019 calculated		55.19	8.79	3.46
K2 2019 estimate min	value	52.48	6.73	3.30
	%	-4.91	-23.44	-4.62

Book value of 1 share				
Triple exponential smoothing				
		ORBIS S.A.	Quantum Software S.A.	Stalexport Autostrady S.A.
K2 2019 estimate max	value	57.90	10.84	3.62
	%	4.91	23.32	4.62
Automatic scheduled				
		ORBIS S.A.	Quantum Software S.A.	Stalexport Autostrady S.A.
K4 2018 source		51.79	9.59	3.26
K4 2018 calculated		49.20	9.56	3.19
difference	value	-2.59	-0.03	-0.07
	%	-5.00	-0.31	-2.15
K1 2019 calculated		50.36	9.67	3.28
K1 2019 estimate min	value	46.64	7.47	3.14
	%	-7.39	-22.75	-4.27
K1 2019 estimate max	value	54.07	11.86	3.41
	%	7.37	22.65	3.96
K2 2019 calculated		51.52	9.77	3.35
K2 2019 estimate min	value	47.81	7.57	3.22
	%	-7.20	-22.52	-3.88
K2 2019 estimate max	value	55.24	11.97	3.48
	%	7.22	22.52	3.88

Source: own material.

Table 5 shows the forecast results for the change in book value of 1 share for all firms and methods. Again for Quantum Software S.A., none of the methods works. For the remaining companies, the results from both triple exponential smoothing and automatic planning can be used to conceptualise the decision, with the smaller error given by the triple exponential smoothing method for Orbis S.A., and automatic planning for Stalexport Autostrady S.A.

Table 6. Method suitability summary.

	Equity capital			Revenues from sales			Book value of 1 share		
	Linear regression	Triple exponential smoothing	Automatic scheduling	Linear regression	Triple exponential smoothing	Automatic scheduling	Linear regression	Triple exponential smoothing	Automatic scheduling
ORBIS S.A.	↘	↘	↘	↘	↗	↗	↘	↗	↘
Quantum Software S.A.	↘	↘	↘	↘	↘	↘	↘	↘	↘
Stalexport Autostrady S.A.	↗	↗	↗	↘	↗	↗	↗	↗	↗

↗ means that the method can be used, ↘ the method should not be used.

Source: own material.

Table 6 summarizes the effects of using predictive methods for three calculated examples for each of the companies. A simple, qualitative method of illustrating the suitability of the method for a specific case was chosen. In the row for Quantum Software S.A., all arrows are down, which means that for this company, none of the methods used in SAC can be used to forecast and justify decisions in the cases under consideration. The charts show large fluctuations in values, which may mean that the data does not meet the assumptions (conditions) required for the methods used. For the remaining companies, in each case we will find a method that allows the forecast to be used to make a decision.

Only one aspect has been presented, but it seems to be a very important aspect of the SAP Analytics Cloud system: making a forecast from the perspective of maintaining key parameters important from the company's point of view.

Conclusions

On the basis of the analysis performed, we can indicate the following conclusions and recommendations:

1. BI class solutions include both technical (IT) aspects, as well as the "vision" of the information and decision-making system functioning in the enterprise.
2. The success of a BI project is primarily determined by the choice and proper adaptation of the implementation methodology, while the choice of the system itself or the implementation company is less important.

3. The dilemma of choosing an "on-premise" or "cloud" solution is a complex problem that requires decision makers to carry out an in-depth SWOT analysis. So far, no unequivocal solutions to the above issue have been developed.
4. The SAP Analytics Cloud system presented in the study as an example of a BI solution in the field of business data processing confirms a wide range of possibilities of using forecasting functions in the field of efficient decision making in business management.
5. The presented examples of forecasting show that there is no universal method that can be applied randomly, due to the fact that the data used to perform the calculations must meet the assumptions of the selected method. As managers are generally not mathematicians by training, they should follow the slightest estimation error when selecting a method or seek advice from professional analysts.

Summing up, we can say that the importance of BI systems for enterprises will grow, especially easily available systems, the results of which can be presented on any device, in any place and at any time.

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What happens when data speak

Abstract

In today's online world, our data is much more accessible to entrepreneurs, managers, etc. Companies have never had so much public information. When segmenting consumer data (cookies), online habits can be read by checking the pages they visit, the information they stop at, and the products they look for. It is easy to find us online, because we create websites ourselves, on which we put a lot of data about our private lives, thanks to which companies are able to carefully select and adapt the message to a specific user so that it is as convincing as possible. All our movements leave a trace on the web, which are later used to define our behaviour, likes, preferences, etc. The article presents the aspect of the possibility of collecting information cookies, as well as the Internet media used in marketing activities. Big data issues were described. It shows what information can be read from the visited pages and how effective data analysis influences decision-making support. The article also addresses the issue of the current state of website privacy protection.

Introduction

People have analysed data for millennia. The invention of writing in ancient Mesopotamia served as a tool for bureaucrats to store and track information. The census in Bible times was also used to gather information about citizens. Collecting and analysing this data in the analogue age was costly and time-consuming. The era of digitization has made great progress in data management, at the collection, storage and processing phases. Therefore, the big data phenomenon was born[1]. Another term for the present day is datatization[2], which means collecting information about everything. The important thing about this concept is that "about everything" means collecting information about matters that we would never think of as data sources. In a report published on the EMC website[3] from 2014, it is clear that by 2020 the amount of data we create and copy per year will reach 44 zettabytes, or 44 trillion gigabytes, out of 4.4 zettabytes in 2013. The digital age has made data processing faster and simpler. The digital world is really accelerating. Millions of calculations can be made in a second. In order to to answer a question: what information about ourselves can flow from this data, I decided to analyse three areas with which we meet every day. The first area is searching for information on the Web on websites, the second – applications on smartphones, the third area analysed is the Internet of Things[4].

Statistics

At the beginning, it is worth paying attention to the statistical data from these three proposed areas. The essence of the chapter is to make us aware how much data about ourselves comes from the areas analysed. Statistics show[5] that the users spend 89% of time surfing in applications and 11% on websites. Analysts assume that in 2019 American adults will spend an average of 3 hours and 35 minutes on mobile devices. 48.2% of all internet traffic comes from mobile devices and tablets.

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1 V. Mayer-Schonberger, K. Cukier, *Big data – efektywna analiza danych. Rewolucja, która zmieni nasze myślenie, pracę i życie*, trans. by M. Głatki, Warszawa 2017.

2 *Datatization*, http://bc.wydawnictwo-tygiel.pl/public/assets/322/Cyber%20Media%20 05.2019%20v01.04.pdf (accessed on January 21, 2020).

3 Digital Report, https://www.iotjournaal.nl/wp-content/uploads/2017/01/idc-digital-universe-2014.pdf (accessed on June 3, 2019).

4 I explained the concept in the chapter entitled "In the Internet of Things".

5 *100+ web stats and facts for 2019*, https://www.websitehostingrating.com/internet-statistics-facts/ (accessed on June 3, 2019).

At the end of May 2019 in Poland[6], over 65% of users used mobile devices and about 33% computers. It is estimated that in 2019 there will be around 2.77 billion social media users worldwide, an increase from 2.46 billion in 2017. Users prefer social platforms such as LinkedIn (82%), Twitter (66%), YouTube (64%), Facebook (41%) and SlideShare (38%). Facebook currently has 2.27 billion users, if we only look at Poland[7], users prefer social media platforms such as: Facebook (56%), Pinterest (23%), YouTube (9%), Twitter (4.45%). People spend an average of 2 hours and 15 minutes a day on social networks. Every month, over 2 billion messages are exchanged between brands and users. 45.8% of users say that they prefer to contact the company via messages on social networks than e-mail. These statistics show how a large part of the population uses mobile devices. If you look at the statistics for the third area, you can see that the Internet of Things is exploding. The Internet of Things is contributing to an ever-growing digital universe. In 2011[8], the number of IT devices exceeded the world's population. 20 billion of them were in 2013. Forecasts indicate that by 2020 there will be 32 billion of these devices. Based on the statistical data, one most important conclusion can be drawn. Collecting information about users has never been easier than today. Despite the enormity of the data leakage scandals that sparked a wave of public outcry, people continue to voluntarily share information online. Only the more informed users started to care more about their privacy, and we know that the more devices connected to the Internet, the more we are monitored. And this amount of data will definitely make it difficult to protect our privacy.

Websites

Google operates as many as 60,000[9] searches each second! Google Trends[10] published a list of the most searched queries in Poland and around the world. Statistics

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6 Statistics – mobile devices, computers, http://gs.statcounter.com/platform-market-share/desktop-mobile-tablet (accessed on November 25, 2020).

7 Statistics – social networks, http://gs.statcounter.com/social-media-stats/all/poland (accessed on November 25, 2020).

8 *Internet rzeczy*, https://businessinsider.com.pl/technologie/internet-rzeczy-na-czym-polega-i-jaka-bedzie-jego-przyszlosc/0qtrr3t (accessed on January 30, 2019).

9 Types of results of google search, https://www.sunrisesystem.pl/blog/2357-rodzaje-wynikow-wyszukiwania-google-czyli-jakie-elementy-spo.html (accessed on June 3, 2019).

10 *Google trends in 2018 in Poland*, https://trends.google.com/trends/yis/2018/PL/ (accessed on June 3, 2019).

kept by StatCounter Global Stats[11] indicate that over 98% of Polish internet users use the Google search engine. The constantly improved algorithms allow for quick and accurate returning of the desired results to users. Hundreds of algorithms that allow to instantly personalize the search results of a specific user have contributed to making these results even more precise. In 2009[12], the company's system, based on search queries in the Google search engine, identified the area in which the H1N1 flu virus appeared, based on what people were looking for on the Internet. And what is most important, unlike the Centers for Disease Control and Prevention, Google was able to tell where the flu started in near real-time rather than with a delay of one or two weeks. In 1994[13], the first banner ad was placed on the web and over the past 25 years the world of the Internet has changed radically, which has resulted in changes in the approach to our personal data. According to forecasts by the European Commission, the market value of all available data processed in 2020 in the European Union will reach EUR 739 billion[14]. For several decades, various industries have been collecting data about potential customers and are using it accurately. Thanks to this, companies are able to analyse more closely the interests, needs and weaknesses of the user data. Additionally, companies can categorize and prioritize users in the network – into more or less profitable groups. The advantage for the recipients is, above all, accurate offers of things or services that they may be really interested in. Is tracking Internet users an activity aimed at making life difficult or can it help find valuable websites for the users? As a result, both parties receive a real benefit. The owner of the company receives an increase in income from the sale of services, while the internet user a place where he or she can take advantage of the offer that interests him/her. The very definition of online tracking as: lurking, surveillance, snooping or spying may seem to be a negative solution. Minor and more serious decisions made on the web are constantly analysed and saved, every move, social relationship, interests, etc. are constantly recorded, saved and evaluated. To limit monitoring and constant observation, we can use the Brave browser to browse the pages.

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11 Statistics, http://gs.statcounter.com/search-engine-market-share/all/poland (accessed on Novembrer 3, 2020).

12 V. Mayer-Schonberger, K. Cukier, *Big data – efektywna analiza danych.*

13 20 landmark events that shaped the internet: *20 przełomowych wydarzeń, które ukształtowały Internet*, https://www.pcworld.pl/news/20-przelomowych-wydarzen-ktore-uksztaltowaly-INTERNET-Czesc-1,368895.html (accessed on June 3, 2019).

14 European Commission, European Data Market Study, https://ec.europa.eu/digital-single-market/en/news/final-results-european-data-market-study-measuring-size-and-trends-eu-data-economy (accessed on June 3, 2019).

Brave web browser

Brave Browser[15] is a novelty on the web browsers market that is gaining more and more fans. Although it is still far from Google Chrome or Firefox, thanks to new ideas, Brave can quickly catch up with competitors. The Brave browser was launched in early 2016. Like other browsers, it is free, remembers website authentication information, allows users to navigate websites, run web applications, and view or play online content. Brave blocks ads by default, thus protecting against malware, as well as preventing the extensive tracking that ad networks reach. Internet users are exposed to all kinds of dangers when working with different browsers. The mission of the founder of the Brave browser is to protect the privacy of recipients completely. It does not collect or sell data, which is what makes it distinguishable from the rest. Therefore, no one has access to sensitive data. An important feature of the Brave web browser is the protection of the privacy of users, as the browser uses secure HTTPS connections wherever possible. It is not possible for someone from the outside to find out what websites the internet user was visiting, or what programs he was using at the moment. In addition, the Brave browser protects our data (PESEL number, address, telephone number, payment card number, etc.) and does not fall into the wrong hands. The Brave browser records over a million downloads per month (it should be noted that this does not yet mean a million new users, because after downloading the application, it must still be installed, still though it is showing an upward trend). Brave provides an extra layer of browser security to defend against network monitoring. By default, it blocks cookies and referring files. In one sentence, the browser cares about the protection of user data. There are places on the Internet where you can still be anonymous. That place is the TOR network[16] (The Onion Router or Deep Web, Darknet). A network less accessible, almost completely anonymous. Apart from criminals, hackers, etc., it is used by everyone who cares about privacy. TOR is a system that aims to provide anonymous access to the Internet. By using TOR, we can effectively protect ourselves against surveillance attempts by, among others, dishonest network users, the so-called network traffic analysis, whether it allows for safe personal communication in which anonymity is needed. The operation of the TOR system is based on communication through a dispersed network of network relays, which are provided by the interested parties. The program does not allow the recipients to be tracked by statistical systems installed on the visited websites, which makes it impossible to indicate e.g. our place of residence. Routing used

15 Brave Browser, https://brave.com/ (accessed on June 3, 2019).

16 TOR, https://2019.www.torproject.org/docs/tor-onion-service (accessed on June 3, 2019).

by TOR works by multiple encrypting of packets and forwarding them through several network nodes. Each such onion router, each of which "tears off" a single layer, revealing the next target of the data, thus preventing the knowledge of the content of the message as well as the source and destination addresses. Users, by connecting through a series of virtual tunnels, can exchange information in public networks without violating their privacy. In 2018, in the Brave browser introduced[17] the so-called TOR network support. In December 2018, it was adjusted to be fully compatible with Google's properties. For those using the Brave browser, this means limiting us from being tracked on the web and intercepting our data. Additionally, our location is unknown.

Privacy policy

A "privacy policy" is information posted on a website to inform users what personal data is collected therein and how it is used[18]. When we analyse the privacy policy of the most popular applications or websites, we will find out what standard of data processing the average smartphone user has to face. Data that the user will probably have to consent to include: access to the calendar, contact database, history of viewed pages and bookmarks, access to applications active on a given device, access to the history of dialled numbers, access to all user profiles on a given device, access to content of SMS and e-mail attachments, or even consent to the ability to change general phone settings. We will consent to most of these options without any problems and without any reservations, but many are worth considering. Such an example may be the consent to share contacts stored on the phone, if we do not use the function related to contact management, or to user activity in other applications. Having such data, one can learn the preferences or habits of the user, and the most important intention of the application developers is to collect the data and share this data with third parties. *Panoptykon* Foundation[19] filed complaints with the President of the Personal Data Protection Office against Google and IAB (Association of Internet Industry Employers). *Panoptykon* believes that the standards and technical specifications for user data auctions do not meet the GDPR requirements, and scripts installed on websites transmit a lot

17 Brave Browser, https://brave.com/

18 *Polityka prywatności*, https://poradnikprzedsiebiorcy.pl/-polityka-prywatnosci-w-sklepie-internetowym-wzor-z-omowieniem (accessed on June 3, 2019).

19 *O profilowaniu i śledzeniu*, https://panoptykon.org/sites/default/files/publikacje/panoptykon_raport_o_sledzeniu_final.pdf (accessed on June 3, 2019).

of data, which then reach hundreds of companies participating in the auction. The Foundation claims that the auctions receive much more data (often sensitive data from which we can deduce what we are ill with, etc.) than is necessary to match the ad. Most of the users use these devices almost around the clock, which by default generate such metadata as: IP address, access time, session duration, type of software used, device location. From metadata – combined with information about how a specific person used an application or service (where they clicked, what they looked for, what they bought, how quickly they typed) – a detailed user profile is created, including their personality traits and a description of their habits and individual lifestyle. Such data is often sensitive and deeply interferes with our privacy. Fitness tracker applications, gaining more and more popularity, applications recording the menstrual cycle and sexual behaviour of women that collect data about our very private sphere of life. According to various reports, the average smartphone user actively uses between 27 and 30 applications per month. Due to the amount of text (on average, the privacy policy is about 2518 words, and it takes a few minutes to read it), only a few will read their terms and conditions and privacy policies. I asked the question of the privacy policy for the purposes of this article (in a survey) to a group of 71 people aged 17–18. The first question was: "Do you know what a privacy policy is?" Over 63% answered that they knew, while over 33% of the answers were – "I've heard something about it in the past". Only 2.8% do not know what it is. The privacy policy regulations of the most popular applications are long, often unreadable and incomprehensible to a potential user. The second question I asked in the same survey was: "Have you ever read the privacy policy?" And to this question only 15.5% answered yes. On the other hand, almost 48% answered no. The rest of the respondents replied that they had started but not finished. Consequently, app developers take advantage of our lack of vigilance when accepting various options. After asking for acceptance of the regulations several times, we often unknowingly select the "I agree" option. It is also worth paying attention to dark patterns[20]. Dark patterns are tricks, "mean practices" used in websites and applications that make us do things that we would not want to do after further reflection. This is a purposeful activity of the company, aiming at obtaining defined material benefits or obtaining consent for the marketing shipment. It is worth talking about newsletters from which it is difficult to unsubscribe, or when booking a flight, where all additional options are usually paid in advance and you should be careful when ordering a ticket. The most common practices used in websites or applications are: unclear messages, where we do not know what to select, size and colour of action buttons, advertisements that pretend

[20] *Dark patterns*, https://www.darkpatterns.org/ (accessed on June 3, 2019).

that they are not, etc. Devices such as smartphones and next-generation personal computers have become a key tracking and profiling tool for commercial purposes.

Cookies

Cookies[21] (cookie) is information that the website sends to the web browser and which is saved in the device's memory in text form. The policy of cookies refers to storing and using by the search engine small fragments of text introduced by the Internet user. Due to such actions, the user switching between pages or returning to previously viewed pages does not have to re-enter data, as it is added automatically by the search engine. Cookies are used in internet statistics and to personalize the advertising message, but they do not contain data that would allow the identification of the user. There are often questions about the privacy of users on the Internet and the security of data stored in this form. This is not the focus of this chapter and will not be discussed further. In 2012, the European Union imposed an obligation on all Member States to introduce changes to the information on websites about such practices. A year later, the Act – Telecommunications Law – was amended in Poland, in which, pursuant to Art. 173, website owners are obliged to post a message about the storage and use of end-user data[22].

Customization

Another important issue in terms of the data we put on the Internet is personalization. In the 21st century "personalization"[23] took on special importance. It made it possible to offer a wide audience of various products and services directly tailored to the individual needs of each individual. Currently, companies allow, for example, any combination of thematic channels on digital TV, serving your favourite take-away coffee in a mug bearing the name of the customer, or even adjusting the temperature in a hotel room according to our preferences. By observing the dynamics of the progress of personalization activities, the user has the impression

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21 A.R. Simon, S.L. Shaffer, *Hurtownie danych i systemy informacji gospodarczej*, Oficyna Ekonomiczna, Kraków 2002.

22 *Cookies*, https://ico.org.uk/for-organisations/guide-to-pecr/cookies-and-similar-technologies (accessed on June 3, 2019).

23 *Personalizacja*, https://ruj.uj.edu.pl/xmlui/bitstream/handle/item/72290/jablonska_personalizacja_internetu_zagrozenie_czy_naturalny_proces_2019.pdf?sequence=1&isAllowed=y (accessed on June 3, 2019).

that they were created exclusively for him. In the 90s of the 20th century, the creators of the AltaVista search engine created an algorithm that allowed to enter keywords in many languages and did not include conjunctions or phrases irrelevant for a given search in multi-word phrases. As a result, the search area was limited by at least several million websites. Currently, personalization is taking all steps related to the adaptation of the content returned by search engines to the individual needs of each user based on the actions taken by him in the past in the virtual space. And in this way, something that was supposed to improve the method of obtaining information, at the same time limited access to it. Each of us, through activities undertaken on the Internet and sharing our own data, significantly narrows the space of information that reaches them. It is a closed space that already receives filtered information, dedicated to individual users.

Applications

In May 2019[24], information spread around the world about vulnerability in the popular WhatsApp application, thanks to which hackers were able to install malware on their victims' phones. 0-day attacks, which rely on the use of a previously unidentified vulnerability to break into the victim's system, remain a serious threat to corporate data all the time. In March 2018[25], the media reported that in "thisisyourdigitallife" quiz prepared by a Russian working at the University of Cambridge, Facebook obtained information from 87 million user accounts, also those who did not take part in the game. Importantly, only 270,000 people took part in the quiz. After many app scandals, users have realized that apps are tracking users. The only question is what it means in practice. It is well known that Google and Facebook are following us for advertising purposes. On the other hand, the simplest applications track us, provide information about how we navigate through the application, and use this data as a source of knowledge to improve the application. The statistics[26] report that we are followed to a greater or lesser extent by about 90% of the applications available on the Play Store. As a rule, it does not mean much for the user, but for the developer it does. The programmer learns what needs to be improved and in what direction to develop the application. And such

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24 *Cyberatak*, https://www.cyberdefence24.pl/whatsapp-dotkniety-cyberatakiem-apel-do-wszystkich-uzytkownikow (accessed on June 3, 2019).

25 Blog close to technology, https://www.spidersweb.pl/2018/12/facebook-podsumowanie-2018.html.

26 *Śledzenie użytkowników – co wiedzą o nas aplikacje?*, https://android.com.pl/programowanie/167513-sledzenie-uzytkownikow-co-wiedza-o-nas-aplikacje/ (accessed on June 3, 2019).

information is invaluable knowledge from the point of view of the application developer. If it involves violating privacy (e.g. sending contacts from our phone or photos to external servers for commercial purposes), this is a cause for concern. As a rule, these is only data that we have agreed to share, otherwise the application cannot send our photos or contacts to the server. You should be vigilant and closely "observe" the application in terms of, among other things, phone battery consumption or the internet package, because these applications can send a lot of data that violate our privacy. Norwegian Consumer Board[27] analysed the terms and conditions, including the privacy and behaviour policies of 20 mobile applications. The goal was to look for threats hidden in the end-user conditions and application privacy. Due to the huge number of applications (millions available on the market), NRK did not analyse the application in depth, but above all its purpose was to describe various problems. One of the problems described in the report[28] is the constant tracking of the users. The report tells you which techniques Google uses to make the user accept tracking. These techniques include manipulating click settings, hiding default settings, and misleading and unbalanced information.

Internet of Things

Another important issue is paying attention to the Internet of Things[29], which quickly entered our personal and professional life. One of the first IoTs was a Coca-Cola drink vending machine. This machine was able to report to headquarters how many bottles of cola were left inside and whether they were properly chilled. Since then, access to the Internet was no longer limited to computers and mobile phones, and the history of IoT began. In everyday life, IoT solutions are widely used from smart cars, smart homes to a number of other small devices connected to the Internet and, which is important, connected with each other. All these devices process data about us. "Smart" technology is to make our lives easier, but it can also be used to interfere with our private life. We have the impression that they follow us and analyse our data. Household appliances that we use every day, such as refrigerators, dishwashers, televisions, cameras, child control devices, are connected to the Internet. Internet service providers can easily track our movements using IoT,

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27 *I know your every step*, https://fil.forbrukerradet.no/wp-content/uploads/2018/11/27-11-18-every-step-you-take.pdf (accessed on June 3, 2019).

28 Ibid.

29 *Internet rzeczy*, https://www.sas.com/pl_pl/insights/internet-of-things.html?gclid=EAIaIQobChMI%20vbSqiYSK2%20wIVQ%20cAYCh0qZQQcEAAYASAAEgJGwvD_Bw (accessed on June 3, 2019).

even if these devices serve to protect our privacy. Since they were created, they posed a threat to privacy, but now, due to the increasing scale of their use, this threat becomes even more important. Cybercriminals use IoT devices for their purposes, as exemplified by DDoS attacks[30] (Distributed denial of service) or spying on people, such as through child monitoring devices. Smartphones have made it possible for anyone to use the power of the Internet on small mobile devices that can be used anywhere. And it is this success of smartphones that allowed us to see the potential of connecting other devices to the Internet. Devices from which it is possible not only to transmit but also receive data, e.g. instructions that the device will perform. Already in 2011[31] onwards, the number of IoT devices has surpassed the world's population. Experts also expect that there will be over 30 billion IoT devices worldwide in 2021[32]. In 2025, according to the analytical company IDC – already 80 billion. We meet these devices everywhere. By exchanging data with the Internet of Things, combined with statistical data and using, inter alia, AI, decisions are made and instructions can be sent directly to devices, e.g. to improve their performance. It can therefore be concluded that IoT makes it possible to connect the physical world with the Internet and interact with it through digital devices.

Creating a profile of our person based on data from various sources

There is relatively little data that we knowingly put online. The most popular ones include: name, surname, date of birth, home address, email address, username, passwords, interests, hobbies, declared profession, education or relationship status, searched questions. We put photos, information about the places we have been to. On the other hand, our online activity, applications used in phones or Smart devices say much more about us. We can learn about: time and frequency of Internet connection, data transfer hours, amount of data sent and received, SMS history, URLs, application usage pattern, viewed ads, number of connected devices, shopping habits, online shopping history, cursor tracking typing dynamics, apartment size, food preferences, whether I was bored at work or whether I was on vacation, etc. As we know, user behaviour patterns can tell a lot about users. What the algorithm

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30 *Ataki typu DDos: Cyberinstrumenty*, https: //repozytorium.uph.edu.pl/bitstream/handle/11331 / .../Absi.J.Cyberinstrumenty.pdf (accessed on June 3, 2019).

31 *Internet rzeczy*, https://businessinsider.com.pl/technologie/internet-rzeczy-na-czym-polega-i-jaka-bedzie-jego-przyszlosc/0qtrr3t (accessed on January 30, 2019).

32 *Przemysł 4.0, czyli jak Internet rzeczy zmieni całą gospodarkę*, http://przemyslprzyszlosci.wp.pl/komputer-zamiast-czlowieka-jaka-przyszlosc-zapewnia-nam-technologie (accessed on January 30, 2019).

can learn from the Internet of Things based on the data we provide, based on our activity on the Internet, is definitely too much. The algorithm from information collected from various data sources that we consciously put on the Internet, from active applications on smartphones, from household appliances that are connected to the Internet, to the phone and with each other will create a profile of our person. This information will be: the sports we do, the number of people there are in our household, the diet we use, movies we like, language skills we possess, or whether we buy a house, etc. More information on this subject can be found in the report provided by the Panoptykon Foundation[33].

Threats

The size of data sets is growing rapidly, storage costs are decreasing, tools for analysing them are becoming more effective, and the security of our data storage and the protection of our privacy, despite various measures, is decreasing. Our privacy is threatened not only by trivial online advertising targeted at specific people, but most of all by inappropriate use of data and inappropriate protection of forecasts based on data. At first glance, the functioning of the Internet of Things looks as if a dream came true for a world in which burdensome duties are the domain of machines. But is it really so? We hear a lot about hacker attacks, cybercrime, cyberbullying, viruses and threats. And what if each of us is given power in the form of a telephone, a remote control with which we can do almost anything? Will we not become slaves of this little device? What if "it" stops working? Will we be able to make ourselves a cup of tea? Will we raise the blinds after the night if the phone fails to obey an order? Will we open the door to the house? What about online privacy? We leave a lot of information about ourselves online, where we shop, what we eat, how often we are away from home, what habits we have, what we get sick with – the computer watching us will know about it all. Is this what we want? In the book Big data[34] the authors describe the case of energy companies installing an "intelligent meter" for energy. Readings are taken every six seconds. Each device draws energy in a different way, creating its own profile. Therefore, domestic energy consumption presents information about our preferences, lifestyle, or even illegal interests. The amount of data, applications or the Internet of Things increases the loss of our privacy. In the era of Internet-connected devices, more

33 *O profilowaniu i śledzeniu*, https://panoptykon.org/sites/default/files/publikacje/panoptykon_raport_o_sledzeniu_final.pdf (accessed on June 3, 2019).

34 V. Mayer-Schonberger, K. Cukier, *Big data – efektywna analiza danych.*

attention should be paid to the current law on the protection of our data and efforts to comply with it. What is important in all this is that the value of information is not mainly related to the original use of the data, but above all to its re-use. Users agree (although this piece of information is so extensive that hardly anyone reads it) to view the information, but not to use, for example, a specific query in the Google search engine. It is difficult to agree to something that does not exist yet, and probably no company could incur additional costs to ask users again to consent to the use of, for example, phrases entered in the search engine by an internet user. Asking users for permission for all possible future uses of their data is also not a good idea. In the big data era, privacy has lost much of its effectiveness. The ability to capture personal data is built into the tools we use every day (browsers, smartphones, Internet of Things devices). We do not have to worry if companies collect data to improve their results, but when they affect our private life or our devices, this is a cause for concern.

Conclusions

In recent years, mobile tracking techniques use sensors of various devices such as: e-book readers, smart TV, thermostats, gas sensors, smart refrigerators, glasses, toothbrushes, toys, vacuum cleaners, etc. It is mainly these devices that supply databases with new information and indicators. It is this collected, saved data that is often passed on in real time. Like smartphones, these devices provide companies with uninterrupted access to information on any topic related to customer interests and habits. In addition, the user voluntarily places information online about his family, planned holidays or his interests. The amount of information appearing on the web grows at an unimaginable pace. Even 20 years ago, the Internet was the same for everyone. Search engine users received identical results when typing the same keywords. It is practically impossible to find the desired search results freely. Despite the many negative aspects of the use of information filtering mechanisms, personalization on the Internet is a natural process of web development. This development facilitates and improves communication and extraction of interesting content, products or services on the Internet. However, the negative aspects that result from this personalization are serious and can lead to many threats. At this point, it should be emphasized that the scale of this threat is constantly determined by the activities that the user takes on the Internet. The Internet user can and should influence the reduction of the level of danger, and even its complete reduction. Such specific and direct actions related to protection may be: encryption of correspondence, use of secure passwords and their frequent

change, local storage of documents, use of search engines that protect our privacy and constant monitoring of news related to the protection of our data, and scandals related to data leakage from the applications we use or the devices connected to the Internet. Using free tools involves sharing your data. Of course, every user using the network can completely opt out from them, but only a few will decide on the benefits that you receive in return.

We realize that data analysis companies, the state, corporations, etc. know a lot about us, and maybe even more than a friend. We also already know that this knowledge serves others to profit from our weaknesses, influence our choices or predict what we are going to do. However, we are not fully aware of the consequences if our data from these three analysed areas are used for the wrong purpose and are not properly protected. Today, the Internet of Things penetrates into almost every sphere of life: from smart homes that allow you to automatically regulate the temperature or order missing food, through smart cities that intelligently control road traffic or waste management, to modern factories full of connected sensors, and production machines. In the coming years, the trend towards smart devices will be so pronounced that it will be difficult to buy appliances or home electronics that are not connected to the Internet. We cannot cut ourselves off from the digital world, our digital profile. We cannot delete it. But that does not mean we cannot do anything. You should pay attention to what we consent to, what data we place on the Internet, what applications we download and reasonably navigate in an increasingly digital world.

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Museum e-shop — professional or ignored element of the website?

Abstract

The article presents a method of qualitative research on online museum stores on the example of 30 Polish museums with the highest attendance in 2017. The research showed that not all museums have online stores in online version, and the biggest problem is the low percentage of e-stores enabling electronic payments.

Introduction

The aim of the article is a qualitative analysis of Polish museum e-shops.

Nowadays, museums are becoming more and more aware of the importance of online presence: they commission the creation of modern websites, provide rich educational materials or digitized museum objects, care for the professional running of profiles in social media, but is it similar with a museum e-shop?

A stationary museum shop is often just an addition to a museum, and its potential is not fully used, which may affect the reception of the facility by visitors[1]. And the store should constitute an extension of the institution's offer and help it achieve its statutory goals. Its offer can include products for everyone: from scientific publications, through exhibition catalogues, books for children, to various gadgets with reproductions of works of art, which allows us, for example, to "inform about the values and content of the collected collections, disseminate basic values Polish and world history, science and culture, shaping cognitive and aesthetic sensitivity"[2], also outside the walls of the facility.

A museum e-shop is a specific e-shop. The products available there are often not available elsewhere, such as exhibition catalogues or gadgets with the image of works of art gathered in the institution. This means that museum stores do not compete with each other and do not have to fight for customers, which may mean that in the virtual world they are neglected.

Testing method

The weighted scoring method was used to conduct research on online museum stores.

In the first step, the criteria to be met by the online museum shop were developed, and then weights were assigned to these criteria. In the next step of the research, online stores were analysed in terms of meeting the selected criteria.

The site analysis included the following criteria:

1. Entering the store – assessing whether the hyperlink redirecting to the store's website is easily accessible;
2. Customer account – ability to create a customer account in the store;
3. Product categories – ability to search by product categories;
4. Search – simple search possible;
5. Advanced search – possibility of advanced search;
6. Product information – existence of a product card with a detailed description;
7. Additional products – information about products related in some way to the viewed product, e.g. "also worth reading", "other customers also chose", or "other products from this category";

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1 E. Łongiewska-Wijas, *Sklep muzealny w Polsce. Niewykorzystana przestrzeń oddziaływania i wyzwanie dla zarządzających instytucją*, "Muzealnictwo", 59, 2018, pp. 9–18.

2 Act of November 21, 1996 on museums, Journal of Laws 1996, of 1997, No. 5, item 24, as amended d. (1996), Art. 1.

8. Order via the cart – you can order by placing products in the cart and filling out the order form;
9. Electronic payments – availability of payments other than bank transfer;
10. Availability of regulations – you can read the store regulations at any time during your visit to the website.

These criteria were assigned a score of 0 or 1 depending on whether the criterion was met or not, and the following weights:

1. Store entrance – weight 2;
2. Customer account – weight 1;
3. Product categories – weight 1.5;
4. Search – weight 1.5;
5. Advanced search – weight 0.5;
6. Product information – weight 2;
7. Additional products – weight 1;
8. Order via the cart – weight 2;
9. Electronic payments – weight 2;
10. Availability of the regulations – weight 2.

A weighting of 2 was given to criteria that were considered essential elements of an online museum store and a weighting of 1 to those that facilitate shopping but are not essential. The most important criteria were the ability to easily find a link to the store, detailed information about the products, the ability to order via the cart and pay for the order online, as well as easy access to the terms of use. The possibility of creating a customer account was given a weight of 1 – it is not a necessary element of an online store, but it is useful for frequent purchases or for tracking the order status. Also, information about related products is not necessary from the customer's point of view (but rather desirable for the store – in order to encourage a potential buyer to purchase additional products). The ability to search simple or by categories has been given a weight of 1.5 – not necessary – especially both at once, but they make shopping easier with a larger assortment of the store. The advanced search option was given a weight of 0.5 – it is a useful option, but in the case of museum stores, which usually have a relatively and not very diverse assortment, less important in relation to the simple or category search.

Test results and evaluation

The research was conducted in June 2019 on the websites of 30 museums with the highest attendance in 2017 according to the Central Statistical Office[3]. These are the following museums:

1. The Museum of King Jan III's Palace at Wilanów, www.wilanow-palac.pl
2. The Royal Łazienki Museum, www.lazienki-krolewskie.pl
3. Memorial and Museum Auschwitz-Birkenau in Oświęcim, www.auschwitz.org
4. The Cracow Saltworks Museum in Wieliczka, muzeum.wieliczka.pl
5. The Wawel Royal Castle – The National Collection of Art in Kraków, www.wawel.krakow.pl
6. The Museum of Krakow, mhk.pl
7. The National Museum in Krakow, mnk.pl
8. POLIN – Museum of the History of Polish Jews in Warsaw, www.polin.pl
9. The National Museum in Warsaw, www.mnw.art.pl
10. The Malbork Castle Museum, www.zamek.malbork.pl
11. The National Museum in Wrocław, mnwr.pl
12. The Royal Castle in Warsaw. The Residence of Kings and the Republic of Poland, www.zamek-krolewski.pl
13. The Warsaw Rising Museum, www.1944.pl
14. National Maritime Museum in Gdańsk, www.nmm.pl
15. The Castle Museum in Łańcut, www.zamek-lancut.pl
16. The Museum of the Second World War in Gdańsk, www.muzeum1939.pl
17. District Museum in Toruń, www.muzeum.torun.pl
18. The Historical Museum of the City of Gdańsk, muzeumgdansk.pl
19. The National Museum in Poznań, www.mnp.art.pl
20. The Silesian Museum in Katowice, www.muzeumslaskie.pl
21. The National Museum in Lublin, www.muzeumlubelskie.pl
22. The Zamoyski Museum in Kozłówka, www.muzeumzamoyskich.pl
23. The Castle Museum in Pszczyna, www.zamek-pszczyna.pl
24. The Castle Museum in Niedzica, www.zamek-w-niedzicy.pl
25. The City Museum of Wrocław, www.muzeum.miejskie.wroclaw.pl
26. State Museum at Majdanek in Lublin, www.majdanek.eu
27. Museum of the Family Home of John Paul II in Wadowice, domjp2.pl
28. The Fryderyk Chopin Museum in Warsaw, https://muzeum.nifc.pl/pl

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[3] Statistics Poland, *Museums with the highest attendance in 2017*, [in:] *Culture in 2017*, http://stat.gov.pl/download/gfx/portalinformacyjny/pl/defaultaktualnosci/5493/2/15/1/kultura_w_2017.pdf (accessed on May 21, 2019).

29. Archaeological Museum in Biskupin, www.biskupin.pl
30. Tatra Mountains Museum named after Dr Tytus Chałubiński in Zakopane, muzeumtatrzanskie.pl

The results of the analysis are presented in Table 1.

Table 1. Research results of online museum stores.

Item	Name of the museum	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Total	%
1.	The Museum of King Jan III's Palace at Wilanów	1	1	1	1	1	1	1	1	1	1	15.5	100%
2.	The Royal Łazienki Museum in Warsaw	1	0	1	1	0	1	0	1	0	0.5	10	65%
3.	Memorial and Museum Auschwitz-Birkenau in Oświęcim	1	1	1	1	1	1	1	1	1	0	13,5	87%
4.	The Cracow Saltworks Museum in Wieliczka	1	1	1	1	0	1	0	1	0	1	12	77%
5.	The Wawel Royal Castle — The National Collection of Art	1	1	1	0	0	1	1	1	1	1	13,5	87%
6.	The Museum of Krakow	1	0	1	0	0	1	1	1	1	1	12,5	81%
7.	The National Museum in Krakow	1	1	1	1	0	1	0	1	1	1	14	90%
8.	POLIN — Museum of the History of Polish Jews in Warsaw	0	1	1	1	0	1	1	1	1	1	13	84%
9.	The National Museum in Warsaw	0	1	1	1	0	1	1	1	1	1	13	84%
10.	The Malbork Castle Museum	1	1	1	1	1	1	1	1	1	1	15.5	100%
11.	The National Museum in Wrocław	1	1	1	1	0	1	1	1	1	1	15	97%
12.	The Royal Castle in Warsaw. The Residence of the Kings and the Republic of Poland	1	1	1	1	0	1	0	1	1	1	14	90%
13.	The Warsaw Rising Museum	1	1	1	1	0	1	0	1	0	1	12	77%

Item	Name of the museum	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Total	%
14.	National Maritime Museum in Gdansk	1	0	0	1	0	1	0	1	0	0	7.5	48%
15.	The Castle Museum in Łańcut	0	1	1	1	1	1	1	1	1	1	13,5	87%
16.	The Museum of the Second World War in Gdańsk												
17.	District Museum in Toruń	1	1	1	1	0	1	0	1	1	1	14	90%
18.	The Historical Museum of the City of Gdańsk												
19.	The National Museum in Poznań	1	0	1	0	0	1	0	1	0	1	9,5	61%
20.	The Silesian Museum in Katowice	1	1	1	1	0	1	1	1	0	1	13	84%
21.	The National Museum in Lublin												
22.	The Zamoyski Museum in Kozłówka												
23.	The Castle Museum in Pszczyna	1	1	1	1	1	1	1	1	0	1	13,5	87%
24.	The Castle Museum in Niedzica												
25.	The City Museum of Wrocław	1	0	1	1	1	1	0	1	0	1	11,5	74%
26.	The State Museum at Majdanek in Lublin												
27.	Museum of the Family Home of John Paul II in Wadowice												
28.	The Fryderyk Chopin Museum in Warsaw	1	1	1	1	0	1	0	1	1	1	14	90%
29.	Archaeological Museum in Biskupin												
30.	Tatra Mountains Museum named after Dr. Tytus Chałubiński in Zakopane	1	0	1	1	0	1	0	1	1	0.5	12	77%

Source: own material.

The presented analysis shows that 8 museums do not have online stores. Two museums (9% of all shops) have online stores that meet all the surveyed criteria: Museum of King Jan III's Palace at Wilanów and the Malbork Castle Museum. The average score obtained by existing stores is 12.82 points, which is 83% of the possible points. The below-average value was obtained by 36% of stores.

Table 2 shows the degree of implementation of individual criteria by the existing stores.

Table 2. Degree of meeting the evaluation criteria by existing online stores.

No.	Criterium	% stores
1.	Entrance to the store	86%
2.	Customer account	73%
3.	Product categories	95%
4.	Search	86%
5.	Advanced search	27%
6.	Information on the product	100%
7.	Additional products	50%
8.	Order via the shopping cart	100%
9.	Electronic payments	64%
10.	Regulations available	86%

Source: own research.

It can be seen that among the most important criteria (weighting 2), two are met by all stores: detailed information about the product and the possibility of ordering via the cart. Figure 1 shows an example of information about the product with a button for adding a product to the cart.

Figure 1. Product description in the online store of the Museum of King Jan III's Palace at Wilanów. Source: https://sklep.wilanow-palac.pl/codziennosc-dawnej-francji-zycie-i-rzeczy-w-czasach-ancien-regimeu-p-358.html (accessed on June 30, 2019).

The next two criteria weighing 2: easy identification of entering the store and the availability of the store's regulations at any time of order fulfilment were met by 86% of stores.

The link leading to the store was usually in the top menu (Figure 2). In the case of three stores, the link was difficult to find, for example, on the website of the National Museum in Warsaw, you had to go to the Contact tab, then Store/Bookstore, and only then was the information about the store run on the ArtBookstore platform (Figure 3).

Figure 2. Top menu on the website of the Museum of Krakow with a link to the online store. Source: https://www.muzeumkrakowa.pl/ (accessed on June 30, 2019).

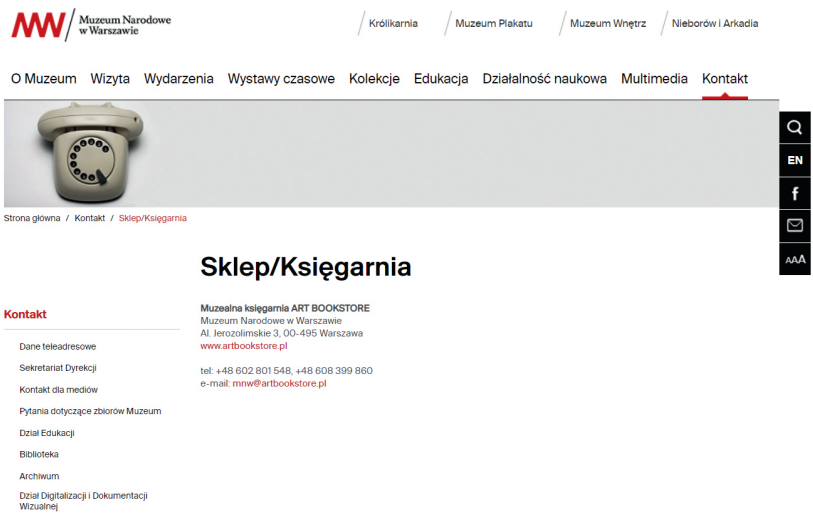

Figure 3. Link to the online store on the website of the National Museum in Warsaw.
Source: https://www.mnw.art.pl/kontakt/sklepksiegarnia/ (accessed on June 30, 2019).

The store regulations were most often linked in the top menu and/or the page footer (Figure 4). However, in the case of the Royal Łazienki Museum in Warsaw and the Tatra Mountains Museum in Zakopane, it was not available at every stage of the ordering process. On the other hand, on the website of the Memorial and Museum Auschwitz-Birkenau in Oświęcim, the regulations were incorrectly linked and did not open (Figure 5).

Figure 4. Regulations of the online store on the website of the Castle Museum in Łańcut.
Source: https://sklep.zamek-lancut.pl/ (accessed on June 30, 2019).

Figure 5. Error in opening the page with the regulations in the online blind of the Memorial and Museum Auschwitz-Birkenau in Oświęcim.

Source: http://www.auschwitz.org/ksiegarnia/regulamin (accessed on June 30, 2019).

The last criterion weighing 2: the possibility of online payment was met by only 64% of stores.

This is not only the domain of smaller museums with less modern websites, the museum is already the second most visited museum in 2017 according to the Central Statistical Office, i.e. the Royal Łazienki Museum in Warsaw, in its e-shop it is only allowed to pay via a traditional bank transfer (Figure 6).

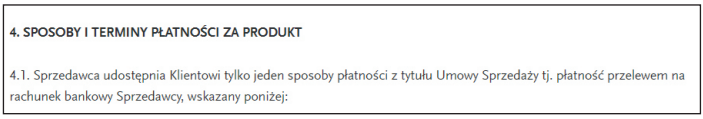

Figure 6. Point of the e-shop regulations of the Royal Łazienki Museum in Warsaw regarding the methods of payment for the order.

Source: https://www.lazienki-krolewskie.pl/pl/e-sklep/regulamin (accessed on June 30, 2019).

Criteria weighing 1.5: Search via product categories and the search box were met by 95% and 86% of stores respectively.

The number of product categories obviously depended on the store's offer. Figures 7 and 8 show examples of e-shop categories.

Figure 7. Product categories of the online store of the Museum of King Jan III's Palace at Wilanów.
Source: https://sklep.wilanow-palac.pl (accessed on July 1, 2019).

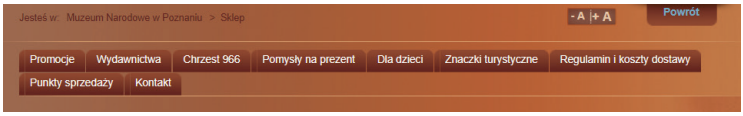

Figure 8. Product categories of the online store of the National Museum in Poznań.
Source: https://www.mnp.art.pl/sklep/ (accessed on July 1, 2019).

Weighting 1 criteria: possibility to set up a customer account and information about products related to a given product were met by 73% and 50% of stores, respectively.

Figure 9 shows an example of a new customer registration window.

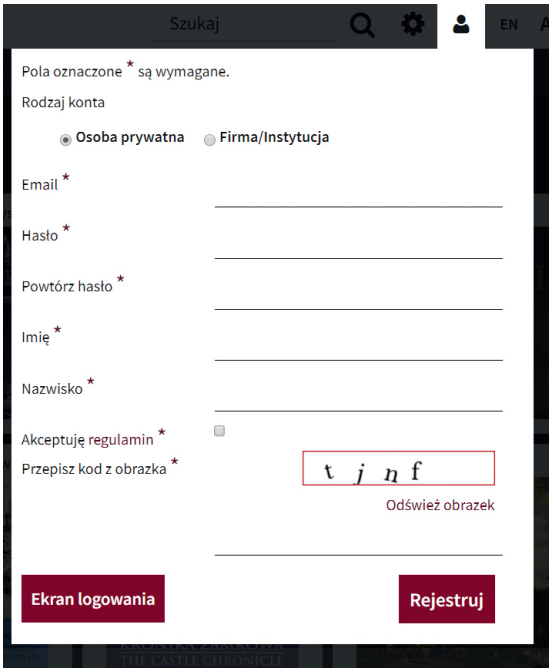

Figure 9. Registration of a new customer in the online store of the Royal Castle Museum in Warsaw.

Source: https://esklep.zamek-krolewski.pl/ (accessed on July 1, 2019).

Cross selling was carried out in various ways. Most often there was information about new products or recommended products (Figure 10), but also the incentive "customers also bought" or other products from a selected category (Figure 11).

Figure 10. Cross selling in the online store of the Museum of Krakow.
Source: https://www.muzeumkrakowa.pl/sklep/krzysztoforek-nr-34-1 (accessed on July 1, 2019).

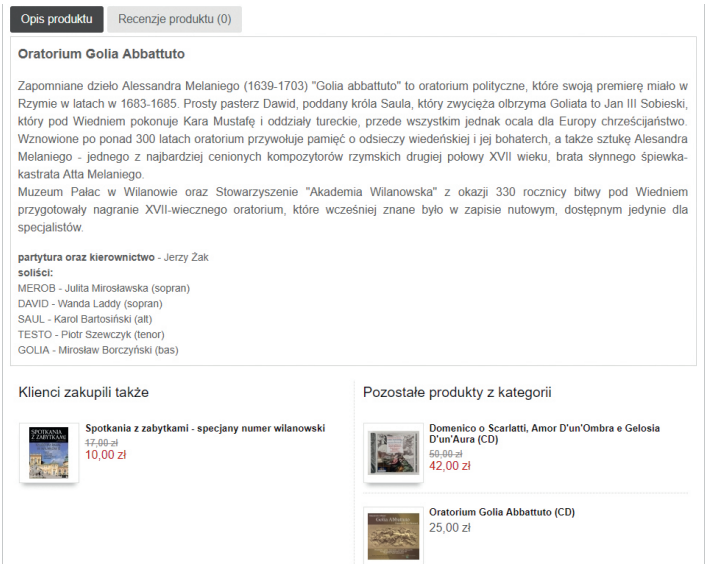

Figure 11. Cross selling in the online store of the Museum of King Jan III's Palace at Wilanów.
Source: https://sklep.wilanow-palac.pl/oratorium-golia-abbattuto-dvd-p-304.html (accessed on July 1, 2019).

The least important criterion, weighing 0.5 – the possibility of advanced search was met by 27%.

Examples of advanced search methods are shown in Figures 12, 13 and 14.

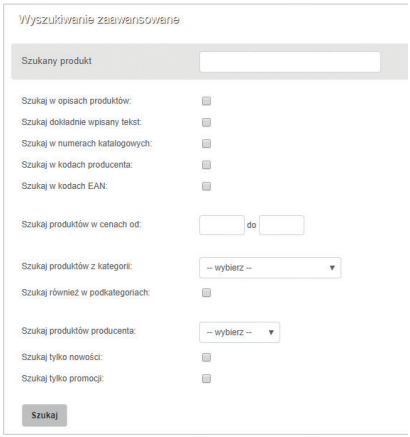

Figure 12. Advanced search in the online store of the Museum of King Jan III's Palace at Wilanów.
Source: https://sklep.wilanow-palac.pl/wyszkuje-zaawodowane.html (accessed on July 1, 2019).

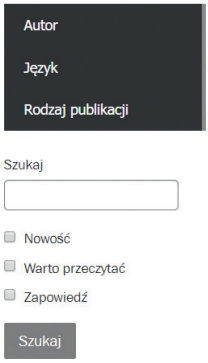

Figure 13. Simple and advanced search in the online store of the Memorial and Museum Auschwitz-Birkenau in Oświęcim.
Source: http://www.auschwitz.org/ksiegarnia/ (accessed on July 1, 2019).

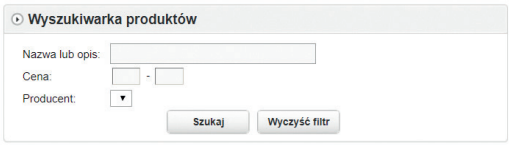

Figure 14. Advanced search in the online store of the Malbork Castle Museum.
Source: http://sklep5549667.homesklep.pl/pl/s (accessed on July 1, 2019).

Conclusions

The conducted research has shown that museums are aware of the need to transfer the museum store also to the virtual world. Unfortunately, the way an e-shop is implemented does not meet the criteria of a modern e-commerce platform. The biggest problem identified in the research is the low percentage of shops offering online payment for the order. Electronic payments are great convenience for customers, their execution usually involves a few clicks, and paying with a traditional transfer, even via the bank's website, may discourage shopping[4]. Online payments also mean that the funds are transferred to the store's account faster and are automatically posted, which usually speeds up the shipment of the order[5]. Museum e-shops should first and foremost enable potential customers to use this form of payment.

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4 P. Winnicki, *Płatności elektroniczne w sklepach internetowych: przegląd rozwiązań*, "Ekonomiczne Problemy Usług", 58, 2017, pp. 277–285, http://bazhum.muzhp.pl/media//files/Ekonomiczne_Problemy_Uslug/Ekonomiczne_Problemy_Uslug-r2010-t-n58/Ekonomiczne_Problemy_Uslug-r2010-t-n58-s277–285/Ekonomiczne_Problemy_Uslug-r2010-t-n58-s277–285.pdf (accessed on July 6, 2019).

5 Ibid.

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Winnicki P., *Płatności elektroniczne w sklepach internetowych: przegląd rozwiązań*, "Ekonomiczne Problemy Usług", 58, 2017, pp. 277–285, http://bazhum.muzhp.pl/media//files/Ekonomiczne_Problemy_Uslug/Ekonomiczne_Problemy_Uslug-r2010-t-n58/Ekonomiczne_Problemy_Uslug-r2010-t-n58-s277–285/Ekonomiczne_1027–285.pdf (accessed on July 6, 2019)

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Research on the usability of museum websites

Abstract

The Internet is the primary source of information on virtually any topic. Everyone, using the right tools, is able to create and share content. With technological development and the transfer of service activities, the role of websites has also expanded, to a large extent owing to the Internet. Initially only informative, they began to perform marketing, communication, booking, payment or educational functions. For many businesses, a website plays a key role in their business. Hence, the need for continuous improvement of websites, and issues related to their design, maintenance and improvement are subject to analysis and research. Therefore, research is carried out on the usability and functionality of websites. The chapter presents the results of research on museum websites.

Introduction

According to data of GUS in 2018, the percentage of people using the Internet amounted to 77.5%, i.e. 1.6 per cent – more than in the previous year. While the percentage of people who use it regularly (at least once a week) equalled 74.8%, i.e. 2.1 per cent more than in 2017. The percentage of enterprises with broadband Internet access amounted to 95.0%, while those with mobile Internet – 67.6%[1]. The development of communication technologies is changing the behaviour of society. The ability to communicate remotely at any place and time also enables faster transfer of information between people. Information has become one of the most valuable and commonly exchanged goods for people[2], used in every aspect of social, economic, cultural or political life. "The information society is constituted by universal access to computers, the ability to use them, developed and relatively common IT knowledge and social acceptance of these manifestations of civilization. An indispensable factor, and probably the reason for the emergence of the information society, was the emergence and rapid development of information technologies (including the Internet)"[3].

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1 Information society in Poland in 2018: Statistics Poland, *Społeczeństwo informacyjne w Polsce w 2018 roku*, https://stat.gov.pl/obszary-tematyczne/nauka-i-technika-spoleczenstwo-informacyjne/spoleczenstwo-informacyjne/spoleczenstwo-informacyjne-w-polsce-w-2018-roku,2,8.html (accessed on May 21, 2019).

2 M. Golka, *Bariery w komunikowaniu i społeczeństwo (dez)informacyjne*, PWN, Warszawa 2008.

3 M. Kęsy, *Społeczeństwo informacyjne w rozwoju cywilizacyjnym ludzkości*, http://cejsh.icm.edu.pl/cejsh/element/bwmeta1.element.desklight-602668b9-47cb-4273-a5b3-31aa20a6634f/c/Kesy_M1.pdf (accessed on December 11, 2018).

The Internet is therefore one of the main and most frequently used sources of information. It is not only a source of current information about the surrounding world in terms of various areas of life. Digitization of library resources allows for the protection of collections, but also their dissemination. "Access to digital collections is also unlimited in time. There is no need to wait for a book to be available and remember the return date. The digital library is open 24 hours a day (except for periodic maintenance). The location of the library will also not restrict access to the collections. You do not even need to know where the nearest facility is, because the collections can be viewed from anywhere in the world"[4]. Therefore, the Internet is also a source of knowledge that was once not as accessible as it is today.

The Internet is the primary source of information on virtually any topic. Everyone, using the right tools, is able to create and share content. Writing and publishing opinions, articles on websites is possible without the need to know complicated technologies. Unfortunately, the published content is not always reviewed and subject to any discussion or confirmation of its credibility. Hence, there are problems with disclosing untrue information to the general public. Such situations appear as a result of intentional action, or not on purpose, e.g. when they result from incomplete knowledge of the author of the texts.

However, websites may perform other functions than opinion-forming. With technological development and the transfer of service activities, the role of websites has also expanded, to a large extent owing to the Internet. Initially only informative, they also began to fulfil other roles, including marketing, communication, booking, payment or education. The information that is posted on the websites of enterprises and various types of institutions is becoming more and more complex, has many subpages, links, and facilities that allow for efficient and intuitive navigation to content interesting for the recipient. For many businesses, a website plays a key role in their business. Hence, the need for continuous improvement of websites, and issues related to their design, maintenance and improvement are subject to analysis and research. This need is justified. Internet users do not like to wait, especially nowadays when they are used to performing multiple operations simultaneously and instantly. Therefore, no tolerance is observed for even the smallest imperfections of the pages. Too slow page loading or overload of information on the page that makes it difficult to find something that the user is interested in, may result in the fact that he will never return to a given page. Moreover, websites

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[4] B. Spadło, *Digitalizacja zbiorów bibliotecznych – forma ochrony i szansa na upowszechnianie informacji*, "Infotezy. Internetowy periodyk naukowy poświęcony mediom i nauce o informacji", 3, 2013, 2, http://www.ujk.edu.pl/infotezy/ojs/index.php/infotezy/article/view/75/193 (accessed on December 14, 2018).

should be intuitive to use, and waste of time learning where to find specific information will certainly discourage users. We deal with a well-designed website when the user, without unnecessary translation and additional information, knows what and how to do it to achieve an intended goal. Therefore, in the area of functionality and usability of the websites, qualitative and quantitative research is carried out. In the further part of the study, the issues related to conducting this type of research will be presented, as well as the results of research conducted on the websites of museums and cultural institutions.

Website usability

When designing websites, it should be remembered that in addition to refined substantive content and perfect graphic design, one should not forget that the website should meet the expectations of users in terms of its usability. An inadequately designed website can discourage potential users. "Users invest very little time (very often they do not stay longer than 10 seconds), looking at the site in the hope that this one will be one of the better ones. However, if a site looks too strange or too complex, or if the user is unable to determine how the site can solve his current problems, he will get away as soon as he can click the mouse". Hence, instead of attracting recipients, it may be a situation in which the user will never appear on a given page. In order to define the quality requirements of both the system and the software, the designer should clearly identify the quality requirements of the recipients. This should be based on the product quality model, and the product goals are defined at the design stage[5].

Therefore, research is carried out on the usability and functionality of websites. Usability and functionality are concepts often confused or used interchangeably. It is more difficult here since the concept is also used in many publications as "usability" and is translated to functionality, which can additionally introduce chaos. Hence, it is best in this case to follow a definition contained in the relevant standard ISO / IEC 25010: 2011. Systems and software engineering – Systems and Software Quality Requirements and Evaluation (SQuaRE) – System and software quality models. As defined within this standard, "usability" is "the extent to which a given product or system can be used by specific users to achieve certain goals, with effectiveness, efficiency and satisfaction in a given context of use". Functionality,

[5] K. Esaki, *Quality Requirement and Evaluation System. Importance of application of the ISO / IEC25000 series*, "Global Perspectives on Engineering Management", 2, 2013, 2, pp. 52–59, http://www.academicpub.org/gpem/paperInfo.aspx?paperid=11919 (accessed on July 5, 2018).

on the other hand, is defined as a trait that represents a degree to which a product or system provides functions that meet specific and default needs when used under the conditions indicated. The above standard defines eight quality characteristics of systems and software, i.e.[6]:

- Functional suitability,
- Performance efficiency,
- Compatibility,
- Usability,
- Reliability,
- Security,
- Ease of maintenance (Maintainability),
- Portability.

The listed characteristics are divided into sub-characteristics, which in the case of usability are divided into: recognition, learning, operability, protection against user errors, interface aesthetics and accessibility. The individual sub-characteristics are defined below:

- recognition is related to a degree to which users are able to determine whether a given product or system meets their needs;
- learnability refers to a degree to which a product or system can be used by people after reaching a certain level of training to use this product or system allowing for its use, inter alia, in an effective and efficient manner;
- operability is related to a degree to which individual system attributes facilitate its operation and control;
- protection against user errors is another sub-characteristic that is related to determining a degree to which the system protects the user against the possibility of making mistakes;
- interface aesthetics relates to a degree to which the user interface allows for a pleasant and satisfying interaction for the user;
- accessibility is related to the possibility of using a system and a product by people with different abilities and characteristics.

Well-prepared websites should be useful, which is why websites of museums and cultural institutions have been researched in this respect, and the results of the research have been included in this study.

6 Ibid.

The role of the websites of museums and cultural institutions

Nowadays it is difficult for museums and cultural institutions to function without a website. The scope of museum activities is regulated by an appropriate act. The role to be played by the parties to such institutions is therefore directly related to their statutory activity. This is stated in Art. 1 and Art. 2:

"Article 1. The museum is a non-profit organizational unit, the purpose of which is to collect and protect permanently the natural and cultural heritage of humanity of a tangible and intangible nature, provide information about the values and content of the collected collections, disseminate the basic values of Polish and world history, science and culture, and shape cognitive and aesthetic sensitivity as well as enabling the use of the collected collections.

Article 2. The museum pursues the goals set out in Article 1, in particular by:

1. collecting monuments within the statutory scope;
2. cataloguing and scientific processing of the collected collections;
3. storing the collected relics in conditions ensuring their proper condition and safety, and storing them in a manner accessible for scientific purposes;
4. securing and preserving collections and, as far as possible, securing immovable archaeological monuments and other immovable objects of material culture and nature;
5. arranging permanent and temporary exhibitions;
6. organizing research and scientific expeditions, including archaeological ones;
7. conducting educational activities;

7a. supporting and conducting artistic activities and those promoting culture;

8. providing access to collections for educational and scientific purposes;
9. ensuring proper conditions for visiting and using the collections and collected information;
10. conducting publishing activity"[7].

Therefore, the tasks of museums include the collection and protection of goods and cultural heritage of mankind, both tangible and intangible, as well as informing about the values or content of the collected collections, disseminating the values of history, science, Polish and world culture. The task of the museum is also to shape cognitive and aesthetic sensitivity, and to enable the use of the collections. Due to the possibility of disseminating information offered by the Internet, it is an

[7] Act of November 21, 1996 on museums, Journal of Laws 1996, of 1997, No. 5, item 24 as amended, http://prawo.sejm.gov.pl/isap.nsf/download.xsp/WDU19970050024/U/D19970024Lj.pdf (accessed on October 12, 2018).

appropriate medium for the implementation of at least some of the above-mentioned tasks of this type of institution.

The study of the usability of websites of museums and cultural institutions — methodology

The website usability study was conducted for 30 Polish museums. Among the many criteria that can be used to select museums, it was decided to take into account the criterion of the highest attendance. The selection itself was based on GUS data on attendance in 2017[8]. A list of selected museums is presented below:

1. The Museum of King Jan III's Palace at Wilanów, www.wilanow-palac.pl
2. The Royal Łazienki Museum in Warsaw, www.lazienki-krolewskie.pl
3. Memorial and Museum Auschwitz-Birkenau in Oświęcim, www.auschwitz.org
4. The Cracow Saltworks Museum in Wieliczka, muzeum.wieliczka.pl
5. The Wawel Royal Castle – The National Collection of Art in Kraków, www.wawel.krakow.pl
6. The Museum of Krakow, mhk.pl
7. The National Museum in Krakow, mnk.pl
8. POLIN – Museum of the History of Polish Jews in Warsaw, www.polin.pl
9. The National Museum in Warsaw, www.mnw.art.pl
10. The Malbork Castle Museum, www.zamek.malbork.pl
11. The National Museum in Wrocław, mnwr.pl
12. The Royal Castle in Warsaw. Residence of the Kings and the Republic of Poland, www.zamek-krolewski.pl
13. The Warsaw Rising Museum, www.1944.pl
14. National Maritime Museum in Gdańsk, www.nmm.pl
15. The Castle Museum in Łańcut, www.zamek-lancut.pl
16. The Museum of the Second World War in Gdańsk, www.muzeum1939.pl
17. District Museum in Toruń, www.muzeum.torun.pl
18. The Historical Museum of the City of Gdańsk, muzeumgdansk.pl
19. The National Museum in Poznań, www.mnw.art.pl
20. The Silesian Museum in Katowice, www.muzeumslaskie.pl
21. The National Museum in Lublin, www.muzeumlubelskie.pl
22. The Zamoyski Museum in Kozłówka, www.muzeumzamoyskich.pl
23. The Castle Museum in Pszczyna, www.zamek-pszczyna.pl

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[8] Statistics Poland, *Museums with highest attendance rate in 2017*, [in:] *Culture in 2017*, http://stat.gov.pl/download/gfx/portalinformacyjny/pl/defaultaktualnosci/5493/2/15/1/kultura_w_2017.pdf (accessed on May 21, 2019).

24. The Castle Museum in Niedzica, www.zamek-w-niedzicy.pl
25. The City Museum of Wrocław, www.muzeum.miejskie.wroclaw.pl
26. State Museum at Majdanek in Lublin, www.majdanek.eu
27. Museum of the Family Home of John Paul II in Wadowice, domjp2.pl
28. The Fryderyk Chopin Museum in Warsaw, https://muzeum.nifc.pl/
29. Archaeological Museum in Biskupin, www.biskupin.pl
30. Tatra Mountains Museum named after Dr. Tytus Chałubiński in Zakopane, muzeumtatrzanskie.pl

The usability test was carried out on a computer with a monitor connected to the Internet. Due to the need to ensure the same study conditions for all participants during such a study, each study was carried out in the same room and on the same computer.

The research itself was aimed at isolating those elements of the website that may cause the website not to be positively received by users. These are the areas which the user has to consider for a while, are for some reason ambiguous and cause some problems. Identifying such areas of the page during the research on the page being developed allows you to make appropriate changes. During this study, the identification of weaker areas of the pages will allow to diagnose a general condition of museum pages in terms of their usefulness, and – if needed – point to some improvements in this direction.

The study was conducted on the basis of a prepared scenario, on a group of five users from different age groups. During the study, participants were asked to perform specific tasks. The following elements were taken into account during the study:

- navigating the website (navigation);
- speed of finding content on the website;
- search engine operation;
- the ability to customize a website to your preferences;
- finding contact options;
- shopping cart service;
- page loading speed.

Web pages contain various elements, therefore it was possible that due to lack of availability of a given option, the operation about which the respondents were asked could not be performed. In this case, the page action was not evaluated and the cell in the table was to be blank. Three tasks were planned for each of the elements. The fact that individual elements are placed on the website in the right way and work in accordance with the preferences of users, should be concluded on the basis of the extent to which the user was able to complete the task properly. The tasks to check the performance of the site in particular areas in the scenario could not occur one

after the other, so they were placed in different order? This is to confuse users and prevent them from giving an impression of performing the same activities several times. An example of tasks from the scenario is shown below:

- Find information about permanent exhibitions;
- Check if the museum offers online tours;
- Subscribe to our newsletter;
- Check exhibition prices;
- Make purchases in the online store.

Study of the usability of websites of museums and cultural institutions — results

The results obtained for individual areas of the website are presented in Table 1. In the case of page loading speed, the assessment was made by the participants of the study. A person participating in the study had a scale from 1 to 5 at their disposal, where 1 is the weakest and 5 the highest. On the other hand, the remaining areas were assessed on the basis of the ratio of successfully completed tasks to all tasks aimed at assessing a given area on the basis of the results of all survey participants. In this case, the assessment of task performance or non-performance is scored with zero-one. Zero means task not completed, 1 – task completed. The maximum number for the tested items listed in the table and marked with numbers 1–6 is 15, which means that 3 tasks for each item are performed by all five users. However, in the case of page loading speed, assessed by the respondents themselves, the maximum number of points is 25, which means that all users are fully satisfied with loading subsequent pages.

Table 1. Usability test results: 1) page navigation (navigation); 2) speed of finding content on the website; 3) operation of the search engine; 4) the ability to customize the website to your preferences; 5) finding contact options; 6) handling the shopping cart; 7) page loading speed[9].

No.	The name of the museum	Museum website address	1	2	3	4	5	6	7	Total
1.	The Museum of King Jan III's Palace at Wilanów	www.wilanow-palac.pl	15	14	14	15	15	15	25	113
2.	The Royal Łazienki Museum	www.lazienki-krolewskie.pl	14	15	13	15	15	15	25	112

[9] M. Woźniak-Zapór, K. Sorkowska-Cieślak, *Użyteczność, funkcjonalność i dostępność stron internetowych muzeów i instytucji kultury*, Wydawnictwo AFM, Kraków 2018.

No.	The name of the museum	Museum website address	1	2	3	4	5	6	7	Total
3.	Memorial and Museum Auschwitz-Birkenau in Oświęcim	www.auschwitz.org	14	15	14	15	15	14	25	112
4.	The Cracow Saltworks Museum in Wieliczka	muzeum.wieliczka.pl	14	14	15	15	15	15	25	113
5.	The Wawel Royal Castle — The National Collection of Art	www.wawel.krakow.pl	15	14	15	15	14	15	25	113
6.	The Museum of Krakow	mhk.pl	14	15	15	14	15	14	25	112
7.	The National Museum in Krakow	mnk.pl	15	14	15	15	14	15	25	113
8.	POLIN — Museum of the History of Polish Jews in Warsaw	www.polin.pl	14	14	15		14	14	25	96
9.	The National Museum in Warsaw	www.mnw.art.pl	14	15	14	15	15	14	25	112
10.	The Malbork Castle Museum	www.zamek.malbork.pl	14	15	15		15	14	25	98
11.	The National Museum in Wrocław	mnwr.pl	15	15	14	15	14	15	25	113
12.	The Royal Castle in Warsaw. The Residence of the Kings and the Republic of Poland	www.zamek-krolewski.pl	14	15	15	15	15	14	23	111
13.	The Warsaw Rising Museum	www.1944.pl	14	15	14	15	13	15	25	111
14.	National Maritime Museum in Gdansk	www.nmm.pl	14	15	15	15	13	15	25	112
15.	The Castle Museum in Łańcut	www.zamek-lancut.pl	15	14	15	15	15	14	25	113
16.	The Museum of the Second World War in Gdańsk	www.muzeum1939.pl	15	15			15	14	24	83
17.	District Museum in Toruń	www.muzeum.torun.pl	14	15	15	15	15		24	98
18.	The Historical Museum of the City of Gdańsk	muzeumgdansk.pl	14	14	15	15	15		25	98
19.	The National Museum in Poznań	www.mnp.art.pl	14	14	14		15	14	24	95

No.	The name of the museum	Museum website address	1	2	3	4	5	6	7	Total
20.	The Silesian Museum in Katowice	www.muzeumslaskie.pl	14	15	15	14	14	14	25	111
21.	The National Museum in Lublin	www.muzeumlubelskie.pl	14	15	15	14	15		25	98
22.	The Zamoyski Museum in Kozłówka	www.muzeumzamoyskich.pl	14	15	14		15	13	25	96
23.	The Castle Museum in Pszczyna	www.zamek-pszczyna.pl	15	14	15	15	15	15	25	114
24.	The Castle Museum in Niedzica	www.zamek-w-niedzicy.pl	12	12	10		13		25	72
25.	The City Museum of Wrocław	www.muzeum.miejskie.wroclaw.pl	14	13			15		25	67
26.	State Museum at Majdanek in Lublin	www.majdanek.eu	14	14	15	14	15		25	97
27.	Museum of the Family Home of John Paul II in Wadowice	domjp2.pl	14	14	15	14	15	14	25	111
28.	The Fryderyk Chopin Museum in Warsaw	https://muzeum.nifc.pl	14	13			15	13	24	79
29.	Archaeological Museum in Biskupin	www.biskupin.pl	14	14			15	14	25	82
30.	Tatra Mountains Museum named after Dr. Tytus Chałubiński in Zakopane	muzeumtatrzanskie.pl	13	14	14	14	15	14	25	109

As a result of the analysis, it can be concluded that in the case of the surveyed museums, operations performed on their websites do not cause many difficulties for users. Taking into account a total number of points, both from the assessment of the implementation of tasks and the assessment issued directly by the respondents, it can be seen that the result of over 75% was obtained by the websites of 25 museums, i.e. 83% of the respondents. Similarly, good results are visible if we take into account the results of task execution and the users' assessment of page loading speed separately.

The studied museums developed their websites and try to maintain them at a high level of usability. They make sure that their websites are useful to all recipients and try to provide content adequate to their expectations.

Conclusions

Museums and cultural institutions also have websites, but they need to be cared for in order to ensure and maintain their usefulness at a high level. Therefore, main goals of museums consist in collecting and protecting goods and cultural heritage of mankind, both tangible and intangible, as well as informing about the values or content of the collected collections, disseminating the values of history, science, Polish and world culture. Running your own website allows you to achieve these goals, especially now, when the Internet is the first source of information that society uses. The appearance of the website, the speed of loading, or the arrangement of content in the way that its users expect, may determine whether a given page, as well as the museum itself, will be visited by other people. The website is usually a showcase of the museum, the first place that potential visitors will visit, if only to get information about exhibitions or opening hours. The site should therefore encourage visitors.

A well-prepared website will inspire trust. If the museum has devoted time to creating an extensive and well-maintained website, the information is up-to-date, the functionalities work properly, and the user himself has no problems with using it, this will testify to the prestige of the museum itself. The user will return to the website and will want to visit exhibitions held by the museum.

The results of the research conducted lead to the conclusion that museums are aware of the need to ensure that their website is useful. Good research results may indicate that museums attach great importance to this, and pages have been designed and maintained in a way that supports the operation of museums, and is not a barrier for users or an element that presents the museum in a negative light.

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o informacji", 3, 2013, 2, http://www.ujk.edu.pl/infotezy/ojs/index.php/infotezy/article/view/75/193 (accessed on December 14, 2018)

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Purposefulness of conducting practical classes through e-learning platforms

Abstract

Nowadays computer programs have almost unlimited interaction with users. In many cases, simulation programs are perfected to such an extent that they replace physical simulations. Therefore, a question arises whether these programs can be successfully used to conduct practical classes in distance learning. In the article, the authors try to answer this question on the basis of observation of students using simulation programs in e-learning.

Introduction

Simulation is "artificial reproduction of the properties of a given object or phenomenon using its model"[1]. In the case of computer simulation, the model is a computer program that visualizes given physical objects, phenomena or processes. Due to very rapid development of computerization, simulations have recently replaced real experiences. This applies to both the hardware part responsible for the speed of information processing, thanks to which you can create real-time simulations, and the software part responsible to a large extent for graphics, which makes visualizations so good that they often resemble real movies. Of course, in most cases, it is about reducing the cost of obtaining useful data, but also about security. And yes, possible car accidents, carambolas on highways or the spread of fire are simulated[2] during a fire[3] modifying certain parameters of the programs so as to minimize the damage, which in fact translates into creating safer cars, roads and buildings for users.

Simulations are used to design heating, gas or water networks, where, by solving a specific system of equations, it is possible to determine pressure, flow or other parameters of the network in any part of it[4]. Simulations are also used to smooth traffic flow in cities by optimizing the length of traffic lights at intersections and their time correlation. A whole range of CAD (Computer Aided Design) programs was created, to which manufacturers of this software add more and more simulation modules (in addition to this, also strength testing, temperature distributions, kinematics simulations and many others). Thanks to this, it is possible to design both mechanical devices and build structures without material losses, optimize electronic boards as well as electrical cable bundles in buildings or vehicles.

For decades, simulation has also been used in the teaching process. Initially, simulators were used to teach to fly[5], which is where there was great risk of loss of life and destruction of valuable equipment. Most flying schools now use flight simulators[6].

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1 Sjp.pwn.pl/slowniki/symulacja.html (accessed on May 17, 2019).

2 http://ws680.nist.gov/publication/get_pdf.cfm?pub_id=913619 (accessed on May 17, 2019).

3 https://www.nist.gov/el/fire-research-division-73300/fire-web (accessed on May 17, 2019).

4 https://fluidsystems.pl/pl/oprogramowanie/programy-symulacyjne (accessed on May 17, 2019).

5 https://gadzetomania.pl/3742,mechaniczne-symulatory-lotu-jak-uczono-pilotazu-gdy-nie-bylo-komputerow?amp=1 (accessed on May 17, 2019).

6 E.g. http://ventumair.eu/praktyka/pierwszy-kurs-pilotazu/ (accessed on May 10, 2019).

The military began to use simulators for learning to drive tanks and armoured vehicles. And universities and academic centres began to use laboratories – simulation centres, for example in the field of medicine[7].

Currently, computer simulations are also used in the simulations described above. Processing raster graphics with high resolution in real time made it possible to show changes of the image depending on the interaction of the training user, which makes simulations reflect reality perfectly.

There are many companies on the market offering training in soft skills that provide most important information necessary to meet goals set by the client, taking into account methodologies and methods of project management (PRINCE2, Agile, SCRUM)[8].

Simulations were also implemented in general education schools[9] as computer programs that visualize the processes described by various subjects of study. Simulation programs have appeared mainly in physics[10] and entrepreneurship. In the latter case, simulation games are often used, where in addition to simulating, for example, the development of the company under given conditions, there is an element of competition with other users taking part in the game[11]. Nowadays, educational and simulation games have become a separate branch of e-learning[12].

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7 http://park.suwalki.pl/wordpress/pl/oferta/laboratoria/kreatywnosci-akademickiej-centrum-medyczne/ (accessed on May 7, 2019).

8 http://www.codeshare.pl/szkolenia (accessed on May 17, 2019); https://doji-academy.com/ (accessed on November 10, 2020).

9 A. Michaloudis, E. Hatzikraniotis, *Fostering Students' Understanding with Web-Based Simulations in an Inquiry Continuum Framework*, [in:] *Research on e-Learning and ICT in Education: Technological, Pedagogical and Instructional Perspectives 2014th Edition*, Ch. Karagiannidis, P. Politis, I. Karasavvidis (eds.), Springer, 2014; http://ndl.ethernet.edu.et/bitstream/123456789/32437/1/288.Panagiotes%20Anastasiades.pdf#page=118 (accessed on May 17, 2019).

10 http://fizyka1001.5v.pl/podstrony/PROGRAMOWANIE%20C++/PROGRAMOWANIE%20C++.html (accessed on November 12, 2020).

11 http://zshe.nazwa.pl/innowacyjnenauczanie/index.php/materialy-szkoleniowe/matematyka/optymalizacja-i-finanse/14-materialy-szkoleniowe/przedsiebiorczosc/83-rola-gier-symulacyjnych-oraz-e-learningu-w-ksztaltowaniu-postawy-przedsiebiorczej-wsrod-mlodziezy-szkol-ponadgimnazjalnych (accessed on November 12, 2020).

12 C.N. Quinn, *Engaging Learning: Designing e-Learning Simulation Games*, Pfeiffer, 2005; M. Allen, *Michael Allen's Guide to e-Learning: Building Interactive, Fun, and Effective Learning Programs for Any Company*, 2nd edition, Wiley, 2016.

In recent years, training based on virtual and augmented reality has also appeared, mainly concerning soft skills[13], health and safety[14] but also hard ones, such as mounting devices[15]. However, these are expensive trainings mainly due to the need to have special glasses, which in the case of a 30-person class generates costs that are still unattainable for a Polish public school.

Many of the above examples of simulations used in teaching, especially in relation to hard competences based not only on knowledge but above all on skills, need additional equipment – a laboratory. A mere interaction of the image with the movement of the control stick will not convey to the user the overloads that occur in the aircraft during such a manoeuvre or the changes in air pressure when climbing to high altitudes. Therefore, they are not suitable for teaching with the use of e-learning, which is targeted mainly at users studying at home.

Therefore, a question arises whether these programs can be successfully used to conduct practical classes in distance learning.

Selection of training and description of the study

The authors decided to use a simulator in their training in computer networks at the high school level. The training concerned the construction of a local computer network and the protocols used in it at the level of the CISCO CCENT certificate. During the training, various models of local networks were built based on CISCO routers and switches as well as Netgear radio equipment. Both routing and virtual VLANs were used in the networks.

The test group consisted of 89 third-grade students from one of Kraków's vocational schools. As the training was conducted in a blended learning form, the instructors saw in part how exercises were performed by students on the CISCO PacketTracer simulator. Students performed six exercises on the operation of switches, routers and WiFi devices both in the simulator and on real equipment in the school laboratory.

The training consisted of three stages. In the first part of the training, students obtained theoretical knowledge. This knowledge was conveyed in a traditional

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13 https://vrtraining.eu/szkolenia-i-warsztaty/ (accessed on November 13, 2020); https://www.projektgamma.pl/strefa-wiedzy/wiki/wirtualna-rzeczywistosc-w-swiecie-szkolen (accessed on May 17, 2019).

14 https://www.vrpremium.pl/szkolenia-bhp-vr (accessed on November 10, 2020).

15 https://modii3d.com/wirtualna-rzeczywistosc-dla-twojej-firmy (accessed on May 17, 2019); https://giantlazer.com/pl/project/montaz-silnika-odrzutowego-w-vr-demonstracyjna-aplikacja-szkoleniowa/ (accessed on November 12, 2020).

form during lectures, but with the possibility or even the necessity of returning to the teaching content via the e-learning platform.

After obtaining theoretical knowledge, the CISCO-PacketTracer simulator was used for learning for some students. The students had the opportunity to work on the simulator both at school and at home, because each student could install a free version of the simulator. In the simulator, a student was to perform specific tasks using theoretical knowledge, connecting routers, switches, computers and radio equipment and testing the correctness of the system created by the hall.

In the third part of testing the possibility of using the simulator in e-learning, students were to perform identical exercises, however, on real CISCO equipment.

The second group of students had the opportunity to use the CISCO-PacketTracer program, however, other systems were used for doing exercises. It was not decided to completely cut off the students from the simulator due to their well-being and the fact that they had already used this software in their earlier years of learning.

Description of the simulator

CISCO PacketTracer is a powerful network simulator. It makes it easier to understand complex processes that would be difficult to visualize using traditional teaching tools and methods. Thanks to the CISCO-PacketTracer program, instructors and students can design, build, configure and solve problems in networks using virtual equipment that would cost many hundreds of thousands or even millions of PLN in the real world.

The current version 7.0 requires a user to log in via the cisco.netacad.net portal. It is free for instructors and students of local CISCO academies, each of whom has their own login and password to the above-mentioned portal. Hardware requirements do not exceed the capabilities of currently very weak computers. There are versions for Windows and Linux UBUNTU[16]. CISCO-PacketTracer provides the latest versions of CISCO IOS operating systems in its virtual devices, but it should be remembered that this is only a fraction of what is possible to do on real hardware. The protocols supported by the CISCO-PacketTracer program are presented in Table 1.

[16] https://www.academia.edu/32094631/Cisco_Packet_Tracer_7.0_Frequently_Asked_Questions (accessed on November 14, 2020).

Table 1. Protocols supported by the CISCO PacketTracer simulator.

Layer	Supported protocols
App	FTP, SMTP, POP3, HTTP, TFTP, Telnet, SSH, DNS, DHCP, NTP, SNMP, AAA, ISR VOIP, SCCP config and calls ISR command support, Call Manager Express, IoT
Transport infrastructure	TCP and UDP, TCP Nagle Algorithm & IP Fragmentation, RTP
Network infrastructure	BGP, IPv4, ICMP, ARP, IPv6, ICMPv6, IPSec, RIPv1 / v2 / ng, Multi-Area OSPF, OSPFv3, EIGRP, EIGRPv6, Static Routing, Route Redistribution, Multilayer Switching, L3 QoS, NAT, CBAL, Zone-based policy firewall and Intrusion Protection System on the ISR, GRE VPN, IPSec VPN, HSRP, CEF, SPAN / RSPAN, L2NAT, PTP, REP, LLDP
Datalink	Ethernet (802.3), 802.11, HDLC, FrameRelay, PPP, PPPoE, STP, RSTP, VTP, DTP, CDP, 802.1q, PAgP, L2 QoS, SLARP, Simple WEP, WPA, EAP, VLANs, CSMA / CD, Etherchannel, DSL, 3/4 G network support

Source: https://www.academia.edu/32094631/Cisco_Packet_Tracer_7.0_Frequently_Asked_Questions (accessed on November 14, 2020).

After installing and starting the program, the program will ask for login and password, and after connecting to the network and checking the correctness of the above-mentioned security, the main window of the CISCO-PacketTracer program will appear (Figure 1).

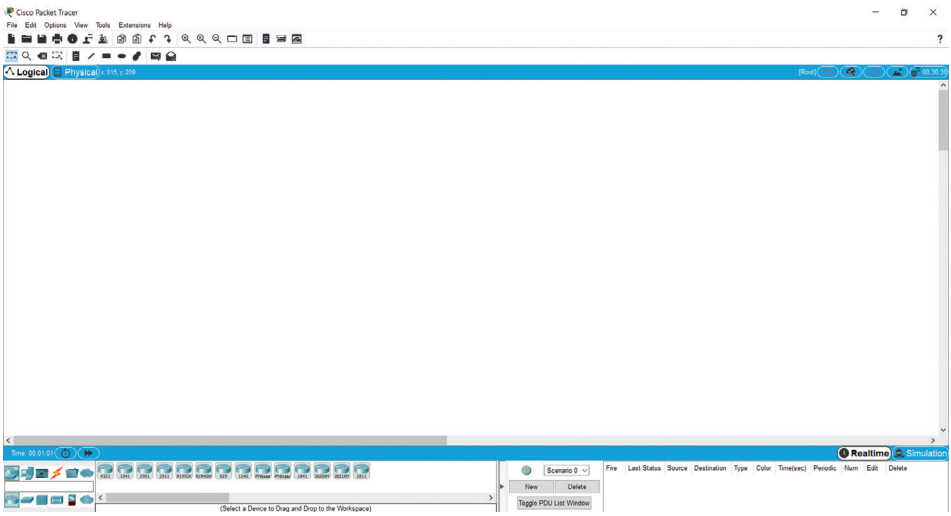

Figure 1. CISCO PacketTracer v 7.2 main window.

Source: own elaboration.

After selecting any device and its model and dragging it to the workspace, you can go to its physical configuration (Figure 2).

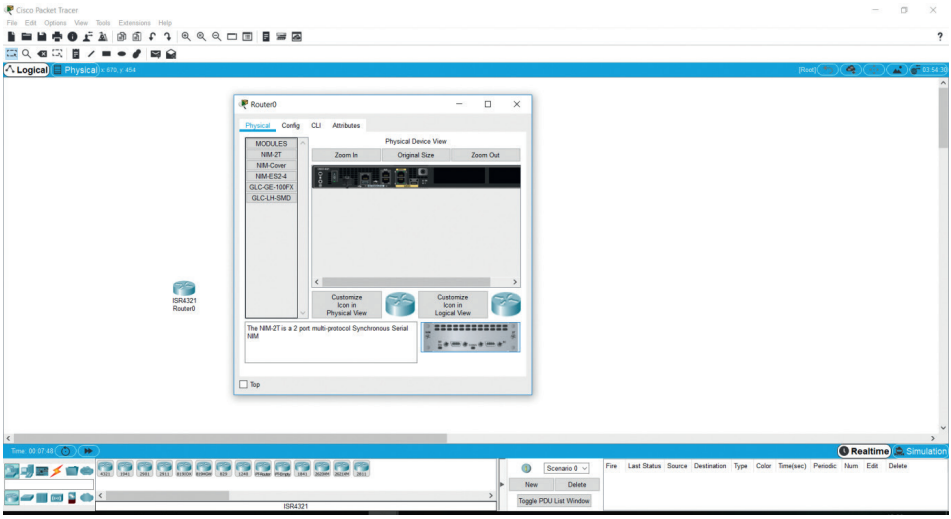

Figure 2. Physical configuration of the router.
Source: own elaboration.

All routers available in the CISCO-PacketTracermodels are modular devices, so expansion cards can be changed. Interestingly, the program teaches young users that they must not change physical configuration of the equipment when the device is turned on, first it should be turned off and then turned on after replacing modules.

After the physical configuration of the devices, you can return to the main window and connect devices with appropriate cables. The simulator will not allow you to connect the cable to the device if its end does not match device interfaces. It should be remembered that both the straight and patch UTP twisted pair have the same terminals, so both of these cables will be able to connect the same devices, however, the network traffic will take place only on the properly selected one. In addition, the creators of the simulator have added an automatic cable in which the simulator will choose the cable. An example of device connection is shown in Figure 3.

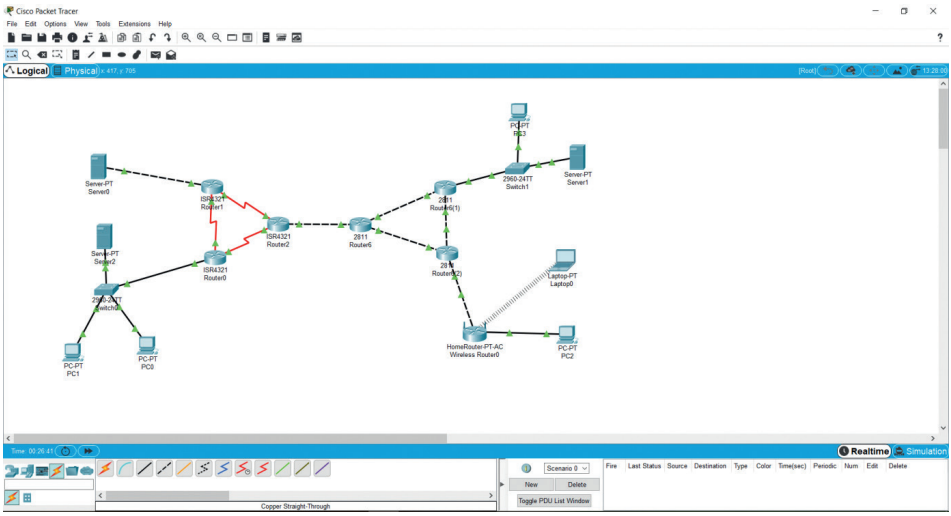

Figure 3. Examples of device connections.
Source: own elaboration.

After connecting devices, you can go to the system configuration of network devices (e.g. interface addressing, routing, VLAN, server configuration). In the case of physical devices, for this purpose the console window is used by entering commands in the text mode. The simulator allows for this type of configuration in the CLI tab (Figure 4). The CISCO-PacketTracer program, however, allows you to configure the most important parameters from the Config tab (Figure 4), which is not available on real hardware. In addition to being configurable, the Config tab acts as a kind of prompter. When making configuration changes in the lower part of the window, commands are generated in the Equivalent IOS Commands window, which must be entered in the CLI window to make changes.

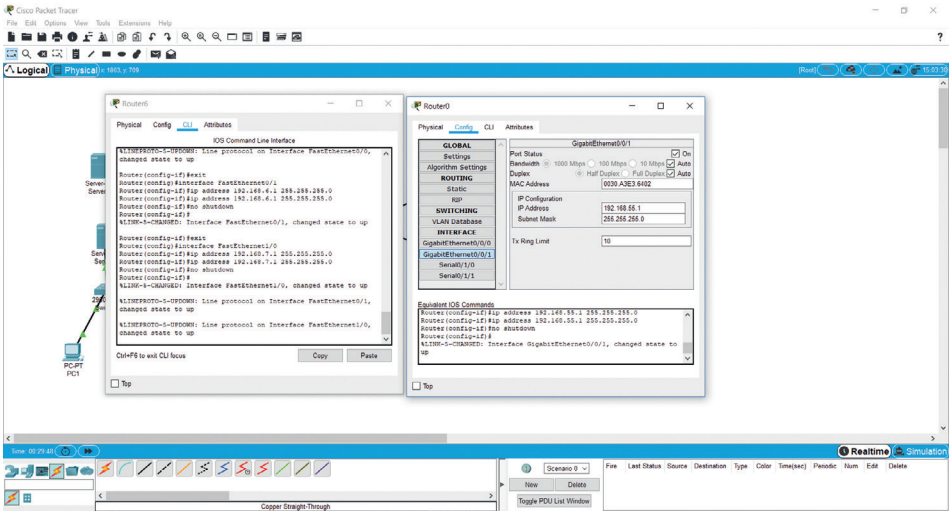

Figure 4. Configuration of the router's operating system. On the left, a graphical interface with prompter, on the right, a text interface.

Source: own material.

In the configuration of hosts (computers, servers, laptops) it is also possible to simulate hardware changes such as expansion card changes and logical changes such as addressing changes or service configuration settings. Addressing configuration is not simulated in any of the operating systems (Windows, UBUNTU, MacOs). However, it is quite intuitive (similar to routers on the Config tab), although the address, host mask and gateway address settings are in different views.

Hosts have one more interesting tab – Desktop (Figure 5), where options are available from the operating system level, for example:

- Windows IP configuration window (IPv4 and IPv6),
- dial-up configuration,
- configuration and view of the terminal window (equivalent to HyperTerminal),
- command line access,
- access to the web browser application,
- wireless network configuration application.

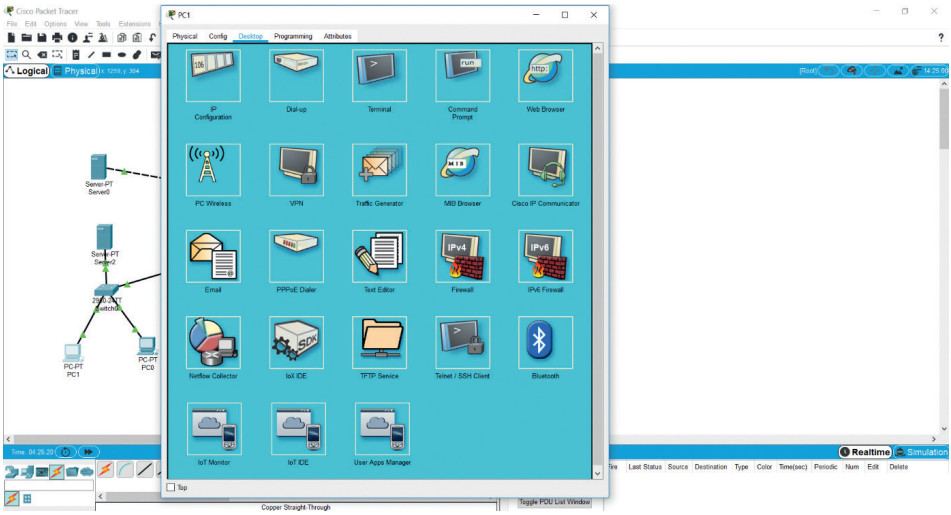

Figure 5. Configuration of the operating system and utility programs on computers.
Source: own elaboration.

After configuring network devices and hosts, you can at any time view the content of dynamically built tables: routing, ARP, NAT, MAC through the magnifying glass icon (Inspect – the second icon in the second row) and indicate a specific one. After selecting the selected table, it will appear in a new window.

There are two methods to check the operation of the network by testing the reachability of hosts and routers:

- from router CLI or host command line as ping IP_address,
- in the main simulation window, select the closed envelope icon and indicate two network points. Program will generate a ping between devices. The result of the operation as a specific scenario (scenario no.) is visible in the "availability test window" (Figure 1).

The communication process along with the TCP/IP/ETHERNET header values can be traced in more detail by selecting Simulation in the "Real Time / Simulation" section (Figure 1).

In this window, you can view all network traffic (narrowed down to the protocols presented in Table 1) or select individual protocols whose traffic should be displayed. This window also allows you to track the point of failure, i.e. a device that does not pass network traffic further. You can also view the headers of protocols sent between any devices. So this program also simulates snipers such as wireshark.

Sample exercise

Two-grade students were to use routine static and dynamic in one task on RIP version 2. In the first part of the exercise, they were to create a circuit consistent with the scheme presented in Figure 6. On the allocated address pool (192.168.2.0/24) they were to calculate the addressing of network devices as shown in Figure 6, knowing that LAN networks would have 20 hosts. Then they were to configure the addressing of network devices and static routing to create routes: K1-R1-R3-R2-K2, K2-R2-R1-K1, and optimal routes from each computer to the Internet (K3). The students then had to test the routes using the ping command. After presenting the results, students had to remove static routes and implement dynamic routing based on RIP v2 protocol, and then test the routes between computers and present the results. If any students were absent from school (9 people for this exercise), they were to do the exercise themselves at home.

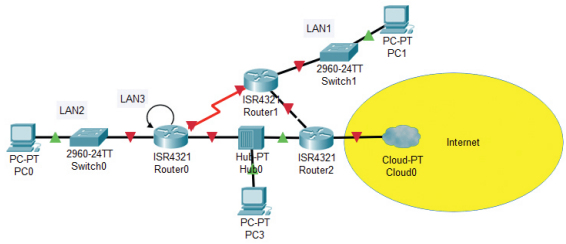

Figure 6. Sample exercise performed in a simulator and then in a specialized workshop.
Source: own elaboration.

The students did the same exercise on real equipment in the school's network lab. For students of one class (29 people), it was a novelty. Due to the insufficient amount of equipment in the facility, the exercise was carried out for six weeks in groups of two or three. Therefore, due to absences, 14 people (9 from the group performing the exercise in the CISCO-PacketTracer program) did not participate in this exercise. In most cases, students coped with actual equipment (47 and 20 people, respectively), however, the time for the students to complete the task after preparation was significantly shorter (average 66 and 84 minutes, respectively). The main problem for people after the preparation was the actual connecting devices with cables and working with the wireshark snifer. There were no significant differences between students performing the simulation exercise in class and at home.

Conclusions

Simulation programs such as CISCO-PacketTracer are perfect complements to the lecture stage, which prepares students to work with real equipment. They can and should be used by teachers both in the classroom and as part of e-learning in homework assignments. Of course, you should bear in mind that simulators are not perfect and will always be different from reality. An example here would be cables and servers always working. It should also be remembered that the network equipment has limited functionality compared to the real one, however, at the high school level or even in college, this does not matter so much as the basic functionality is maintained.

Such programs can also be used during message checks. Initially, the graphic tab for configuration of device interfaces may be an obstacle, but it can be blocked by preparing special exercises. Interestingly, this program is used by CISCO for certification. For example, after passing the Cisco Certified Network Associate 200–125 CCNA exam, two practical exercises take place in this program.

After learning about the simulator, students quickly exercise on it. The same exercises are performed on real equipment, often twice as long. This is partly due to the need to check the cables connecting them, to move between computers and the RACK cabinet, and partly for fear of spoiling something in the real world.

Of course, CISCO-PacketTracer is not the only solution of this type. An example is the GNS3 program, which allows you to simulate virtually any device (provided you have an operating system license for that device). However, this solution is much more complicated, which means that students and teachers are less willing to learn it.

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Knowledge pills, gamification, e-learning courses — knowledge management in the aspect of the university

Abstract

In this chapter, three selected methods and techniques of distance learning will be presented. These include e-learning conducted in university conditions based on an e-learning platform, and thus actually blended-learning. Knowledge pills, i.e. microlearning, will also be discussed. Information related to gamification will also be presented. Each of the three methods or techniques mentioned is used in adult education and each has its own advantages and disadvantages. Do they have a *raison d'être* in university conditions, and which of them can be used and to what extent?

Introduction

Technological development allows to diversify and enrich the didactic process. Various types of teaching aids are available, such as simulators, which enable one to observe what until recently could only be studied in the form of pictures in a book. Teaching with technology becomes easier, faster, and perhaps more effective. The attractive form of various types of courses should not obscure the didactic purpose. Therefore, it is not uncommon when designing them that the author regrets not adding additional graphics or animations "jumping" on the screen in the course, which could obfuscate the content of didactic resources.

From year to year, the interest in various forms of technology related to the creation and sharing of didactic materials changes, so as the way of transferring knowledge and shaping skills, and motivating one to acquire and develop them. Ranking lists are created by various companies and organizations showing trends in the transfer of knowledge that are visible in a given year, as well as forecasting directions of development of techniques, methods and forms of education, also in the field of distance learning. Microlearning is the most frequently mentioned[1] among the trends in distance learning for 2019, as well as virtual/augmented reality[2], adaptive learning[3], artificial intelligence[4], and gamification[5].

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1 K. Greany, *The big digital learning trends for 2019, according to the experts*, https://www.elucidat.com/blog/digital-learning-trends/ (accessed on December 19, 2018).

2 Ibid.

3 S. Kumar, *8 Top eLearning Trends for 2019*, https://elearningindustry.com/elearning-trends-for-2019–8-top (accessed on November 18, 2018).

4 J. Coe, *5 Impactful L&D Trends to Watch in 2019*, https://www.unboxedtechnology.com/2019-training-trends/ (accessed on December 12, 2018).

5 *The Biggest Education Technology Trends for 2019*, https://blog.lambdasolutions.net/biggest-education-technology-trends-2019 (accessed on February 1, 2019).

Due to the above, the instructors have at their disposal various methods and techniques of transferring knowledge at a distance. This type of education allows you to learn in a chosen time, place, and use the knowledge contained in the courses when it is most needed. In this chapter, three selected methods and techniques of distance learning will be presented. These include e-learning conducted in university conditions based on an e-learning platform, and thus actually blended-learning. Knowledge pills, i.e. the aforementioned microlearning, will also be discussed. Attention will also be paid to gamification. Each of the three methods or techniques mentioned is used in adult education and each has its own advantages and disadvantages. Do they have a *raison d'être* in university conditions, and which of them can be used and to what extent?

Platform courses, gamification, micro-learning

Typically, e-learning is understood as a distance course conducted via the Internet. One of the most frequently quoted definitions says that it is "an electronic content resource dedicated to a specific training goal, intended for independent use and equipped with navigation elements"[6]. Blended-learning can be used when learning cannot only be done remotely. It is a combination of traditional classes conducted in a classroom by a teacher, with a course shared and conducted via the Internet using available multimedia techniques. Thanks to this solution, both the learner's contact with the teacher is maintained, as well as the benefits of using a flexible form of education, which is e-learning.

Both in the case of e-learning and b-learning, teaching materials can be made available via the e-learning platform. The courses themselves can be created in tools that enable content to conform to the standards supported by dissemination tools. The advantage of e-learning platforms is the ability to manage the educational process within a group of users, sharing content at a specific time or after performing specific tasks, moderating discussions, engaging learning participants to actively participate in this process.

Adaptive learning was mentioned among the trends in education. It consists in modelling the path of providing students with subsequent didactic materials depending on the level of mastery and understanding of the existing content. It is a reflection of the teacher's behaviour in working with the student. Depending on how he works in the classroom, what he understood and what he should learn – the teacher provides appropriate content or tasks to be carried out. However, this

6 M. Hyla, *Przewodnik po e-learnigu*, ABC and Wolters Kluwer Business, Warszawa 2007.

behaviour can be automated. The implementation can take place in two ways. The first is to design adaptivity, the second is to use an algorithm[7]. In the first case, scenarios of conduct should be determined depending on the data obtained on the basis of test results and tasks performed by the students. In the second case, the adaptability of education consists in the use of algorithms that enable determination of a personalized path for the delivery of further educational materials based on the obtained results. Here, however, the path is not planned in advance by an expert. The level of understanding of a given didactic material is assessed, and on this basis, content is provided to deepen and supplement the material poorly understood by the learner. In the case of good mastery of the content by the student, the algorithm will allow a student to provide subsequent parts of the didactic material.

A different approach to the education process is carried out using gamification. It should be mentioned here that the term gamification itself, used later in this study, is not the only term for activities that will be described here. In the literature, terms "griffin"[8] and "gamification"[9] are encountered. Quoting definitions of gamification, it can be said that it consists in the use of techniques used in role-playing games to model the behaviour of participants in a given process; a situation which, in turn, is not a game[10]. According to a definition given by another author, "gamification is the use of mechanisms from games that mobilize to action, increase involvement or simply make boring, repetitive and monotonous activities more enjoyable. Thanks to it, we voluntarily undertake tasks that we usually cannot force ourselves to do. What we love about games is *friends, feedback and fun*"[11]. Therefore, the main emphasis here is not on providing the right content at the right time, but on increasing the involvement of the participants in the implementation of tasks, processes, activities that might seem boring and routine to them. During the game, the player feels contentment, satisfaction with successful missions and actions completed with success. The principle of operation of gamification in education is to evoke similar feelings. The method of implementation consists in creating situations that allow a participant to overcome difficulties, compete, win awards, but in a different

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7 *Let's Talk About Adaptive Learning*, https://www.smartsparrow.com/what-is-adaptive-learning/ (accessed on November 13, 2018).

8 *Gryfikacja – nowe oblicze gier*, http://www.gryfikacja.pl/index.php/gryfikacja/ (accessed on May 21, 2016).

9 P. Tkaczyk, *Grywalizacja. Jak zastosować mechanizmy gier w działaniach marketingowych*, Helion, Gliwice 2012.

10 G. Zichermann, C. Cunningham, *Gamification by Design: Implementing Game Mechanics in Web and Mobile Apps*, O'Reilly Media, 2011, p. 14.

11 A. Bilska, *Gamifikacja w edukacji*, http://www.nina.gov.pl/baza-wiedzy/gamifikacja-w-edukacji-agnieszka-bilska/ (accessed on October 5, 2018).

environment. Thus, the student – participant in the game of education directs his activities towards a goal chosen by a course designer. During the course, he is motivated to take appropriate actions. A gamification technique itself is used in different walks of social life[12]. There are some applications in business, where the concept of games together with loyalty programs which are in line with the assumptions of behavioural economics is used to build the motivation of people involved in business processes[13]. One example of the use of gamification to create human behaviour is building long-term consumer engagement. The implementation of such a case is the "Vegetable Inspirations" consumer platform created by Gamfi for the Bonduelle brand[14]. The project assumed an increase in the interest among the recipients of this particular brand and its products. The implementation of this task was based on the systematic education of consumers on healthy eating. Education took place in the form of puzzles and rebuses that were user-friendly and offered fun for the audience. The motivation to solve them equalled the possibility of obtaining points, which resulted in a higher position on the ranking list and the possibility of winning a prize. The mechanisms used meant that the participants of the game willingly returned to it, took up new challenges and competed for the prize. Thus, their behaviour was in line with the plans of the event organizers. The participant saw the opportunity to play and win a prize, while for the organizers it was refined information and loyalty campaign conveying and consolidating knowledge about products and the brand.

Among other uses of gamification is the area of marketing activities[15]. It can also prove to be a good way to implement the process of improving traders' skills[16]. It can also be used to increase employee involvement in the performance of their duties, and even additional work for the organization that employs them. Another example is "Idea Street – an online platform to generate, exchange and improve ideas to improve the operation of the UK Department of Work and Pensions". The aim of its creators was to transform a traditional "idea box" into an innovation exchange open to all employees. It was achieved thanks to the implementation of

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12 K. Kaźmierczak, *Grywalizacja – od rutyny do zabawy dającej efekty* (ebook), Wydawnictwo Wiedza i Praktyka, Warszawa 2016.

13 G. Zichermann, J. Linder, *The Gamification Revolution. How Leaders Leverage Game Mechanics to Crush the Competition*, McGraw Hill Education, New York 2013, p. 12.

14 *3 inspirujące przykłady grywalizacji*, http://adnext.pl/przyklady-grywalizacji/ (accessed on May 26, 2016).

15 P. Tkaczyk, *Grywalizacja. Jak zastosować mechanizmy gier*.

16 S. Starzyński, *Hansa – polska platforma gamifikująca pracę handlowców*, http://www.gryfikacja.pl/index.php/category/zastosowanie/praca-zarzadzanie/ published on July 20, 2015 (accessed on May 25, 2016).

mechanisms such as: commenting, voting, creating working groups, gaining points to invest in selected ideas and going through the stages of their improvement[17].

Yet another approach to the learning process is related to micro-learning. It is also a trend that is considered important in 2019. Microlearning is about creating short tutorials. The prepared content should be aimed at performing an activity, acquiring a specific piece of knowledge, but should always lead to the intended learning effect. Micro-learning is carried out in the form of e.g. knowledge pills.

Knowledge pills are one of the newer ways to convey learning content and achieve learning outcomes. In practice, during a few minutes devoted by the student to read a pill, it is possible to provide didactic content on a selected topic. The above pills are not long, but short and designed to make it easy for the reader to remember them. Knowledge pills use various forms of communication, from film, through animation, sound to material in the form of text, illustrations or charts. They should be developed in such a way that they are available for various types of devices. They should be displayed attractively both on the computer monitor screen and on the much smaller smartphone screen. Thanks to their mobility, they are eagerly used by an increasing number of recipients and more and more popular also among the authors of teaching materials. Mobility, in turn, affects accessibility. This is related to the ability to access necessary information in the right place and time, exactly when specific information is needed.

The rules for creating knowledge pills say they should be short, concise, and interesting. Nowadays when every potential recipient of didactic material is distracted by a huge number of external stimuli, he should receive a pill of knowledge that will be able to attract and maintain his or her attention for a short time. Hence, the need to implement the didactic material in the form of short fragments, in the time interval from 3 to 5 minutes. On the other hand, the didactic content should be developed in a way that will be interesting, dynamic and pleasant to perceive. Such requirements already suggest the use of animations, films, graphics, demonstrations to create knowledge pills that are to have an attractive form. It should be remembered that not the information contained in the pills should facilitate understanding and acquiring knowledge about one selected phenomenon, technology, practical skill. They do not constitute a theoretical interpretation in a given field. When creating, one should remember that the pill is to provide knowledge which

[17] K. Rowgało, *Gamifikacja – Co to, po co, jak działa?*, http://hrstandard.pl/2014/03/03/gamifikacja-co-to-po-co-jak-dziala/ (accessed on May 25, 2016).

topic is the most important, without unnecessary digressions and in the shortest possible form. It is provided in a form that one can absorb during the first read[18].

"Information provided in such small and accessible forms is characteristic of informal learning. However, along with dynamic socio-economic development, these elements should be introduced to formal education. The first steps in this direction are taken by training organizations and project initiatives. Internet services that allow users to post very short messages using microblogging such as Twitter (tweeting is sending very short messages of up to 140 characters) are gaining in popularity. Interest in this form of communication can be an interesting alternative in making contact for educational purposes"[19].

Possibilities of using blended-learning, gamification, knowledge pills at the university

Blended-learning, i.e. a combination of classical education taking place in a computer room with elements of courses located on the e-learning platform, has been in use at the university the longest. Universities use both free solutions, based on the Moodle platform, as well as paid solutions, dedicated to specific needs of a given university. Both paid and free solutions allow for the implementation of the educational goal, with a difference that paid solutions have more additional options enabling, for example, easy and effective communication between students and teachers, conducting tests, examinations, and surveys[20].

On some platforms, it is also possible to model the paths of the course provided that the material already covered has been passed. This is the case, for example, of the KA e-learning platform. As part of the lesson, it is possible to make the transition to the next resource conditional after passing the appropriate content indicated by the author of the course. The following figures show how to accomplish this task within the resources available on the platform. There are three training resources and one resource with a final test. Figure 1 shows a situation in which it is possible to count freely individual resources with a drop-down list regarding possible actions to be performed within the resource. Figure 2 illustrates how to select individual resources to be counted prior to testing. Figure 3 shows

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18 A. Laśkiewicz, *Co to jest micro learning*, https://ipro-elearning.com/html/partners/tech/pigulka_wiedzy_krotko.html (accessed on June 26, 2018).

19 D. Dżega, *Metodyka przygotowywania kursów e-learningowych z uwzględnieniem pigułek wiedzy*, http://www.e-edukacja.net/dziewiata/referaty/Sesja_2a_2.pdf (accessed on July 6, 2018).

20 M. Woźniak-Zapór, M. Grzyb, S. Rymarczyk, *Elektroniczna weryfikacja wiedzy – szansa na efektywne jej sprawdzenie*, "EduAkcja. Electronic Education Magazine", 2 (14), 2017, pp. 97–107 (accessed on July 6, 2018).

a display of a blocked resource that will be unlocked only after the student performs appropriate operations, while Figure 4 shows the information window that will be displayed to a person who wants to open the resource without meeting the teacher's requirements.

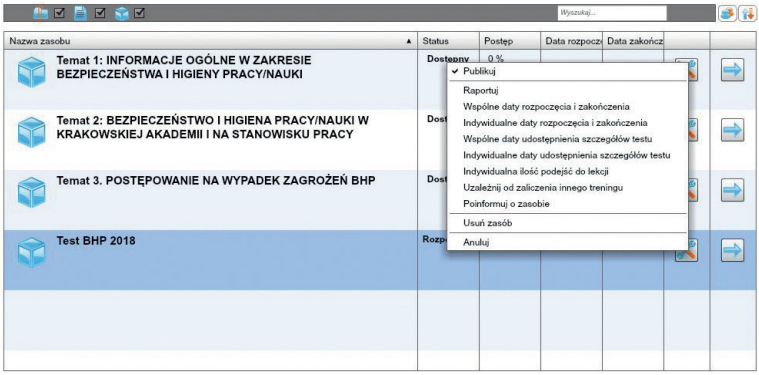

Figure 1. Window with possible operations to be performed on the resource.

Source: own study, screenshot from the KA e-learning platform.

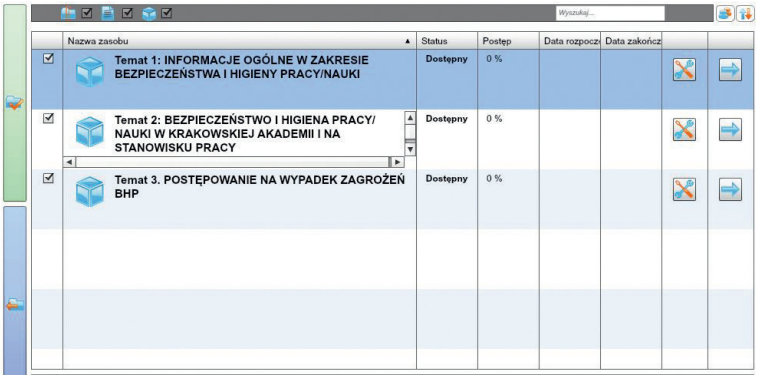

Figure 2. Window for determining the resources required for implementation before starting the test.

Source: own study, screenshot from the KA e-learning platform.

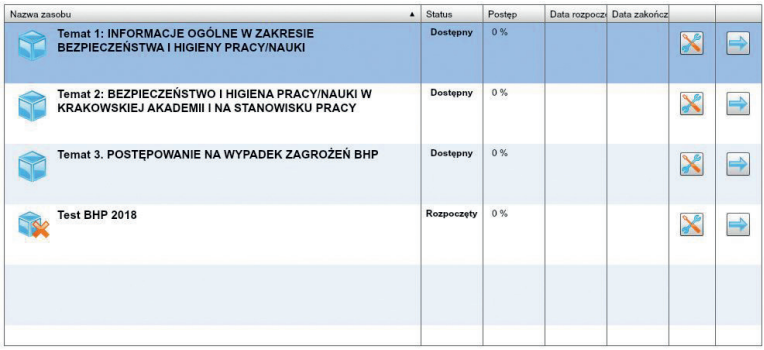

Figure 3. Window with a resource blocked.

Source: own study, screenshot from the KA e-learning platform.

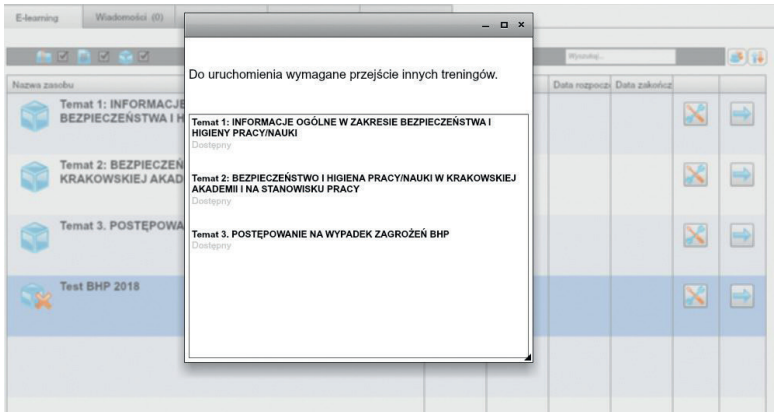

Figure 4. Message about the need to undergo other training.

Source: own study, screenshot from the KA e-learning platform.

The principle of operation described here also applies to the lessons. Lessons mark pieces of content within a single asset. Figure 5 shows the lessons that are not locked, you can go to any of them at any time. As with the resources in the course, here it is also possible to define which lesson should be studied so that one can move to another.

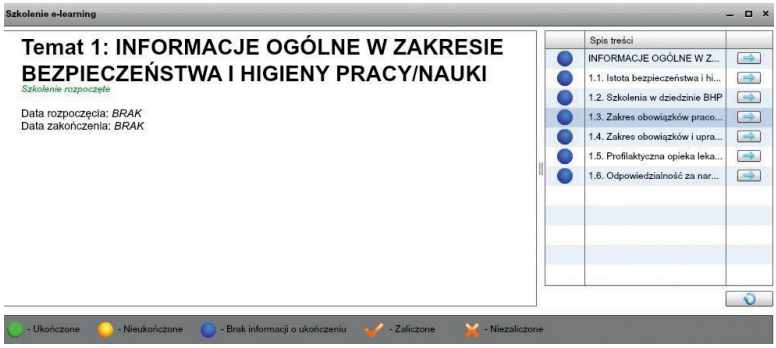

Figure 5. Lesson window, no lesson is locked.

Source: own study, screenshot from the KA e-learning platform.

The e-learning platform is used to share content, communicate between teachers and students, but it also gives the possibility to set paths to transition to individual elements. The example shown can be largely extended by creating various scenarios.

The approach to the educational process as a role-playing game can also be implemented using methods available at the university. One of them is the use of an e-learning platform. Within the KAAFM platform, it is possible to carry out individual tasks, group tasks or do tests. Converting ordinary content and elements that test knowledge and skills in the case of using gamification elements, requires the development of a scenario and presentation of individual resources in the form of e.g. subsequent missions[21]. As a result of such a mission, a student can get specific points or grades, which in turn allow him to take an appropriate position on the ranking list. Such a method is certainly more motivating for students, for example by offering a possibility of competing in a group or winning a prize.

The use of knowledge pills in educating students should also be considered. What can their role be in relation to traditional classes and with the use of distance learning methods and techniques? As part of education at the university, individual issues, knowledge and developed skills are explored. The knowledge pill is antithetical to university education. Knowledge pills, due to their condensed way of presenting the most important information on a given topic, can play an introductory role or consolidate the didactic content presented in traditional or distance classes. All that remains is to solve the problem of how such content is shared. Knowledge pills should be available at all times without hardware barriers. It is not

[21] M. Woźniak-Zapór, M. Grzyb, S. Rymarczyk, *Mechanizmy gamifikacji w kształtowaniu postaw studentów*, "Państwo i Społeczeństwo", 2017, 2, pp. 125–136.

a difficult condition to fulfil. However, is it possible to implement them within the e-learning platform? In the case of the KAAFM platform, it is possible to create pills and share them in teaching groups, access to which is possible after logging in. Such pills could be available to students and could be recreated on computer screens. Thus, they would fulfil a planned role of introducing and consolidating the issues discussed during didactic classes and typical e-learning courses.

Conclusions

Following the trends in education, it is also worth considering what is already used. Some of the trends mentioned for 2019 are also possible to apply and develop based on existing solutions. The e-learning platform is intended to share content and communicate between teachers and students. But it also makes it possible to designate paths to transition to individual elements, creating more complicated paths that enable the content to be adapted to the current needs of students, thus allowing the implementation of adaptive education to some extent.

Usually people are reluctant to learn topics that seem difficult or uninteresting. The use of gamification mechanisms and evoking completely opposite feelings, i.e. satisfaction, satisfaction resulting from the results obtained, working with other people in a group or competition should positively affect the absorption of the content of education provided for in educational activities. Considering that "games have a remarkable power to draw us into their world and motivate us to perform certain actions. Behind this are the psychological mechanisms that developed with us thousands of years ago. When we discover new places, gain new levels, interact with other users and, with a pleasant sense of control, we move towards the final victory, we have no doubt that the experience we are having is positive and we will do a lot to be able to repeat it"[22], it is worth trying to introduce elements of gamification into didactic activities.

Knowledge pills can play an interesting role in the learning process. E-learning courses are extensive, allow one to include many references to source texts and explore the issues in more detail. On the other hand, knowledge pills as short tutorials and summaries of issues that can serve as a summary and consolidation of the most important issues. Therefore, they can enrich e-learning courses in university education. However, this "enrichment of e-courses with knowledge pills should be designed in such a way that they do not interfere with the implementation of

[22] *Osiągnij przewagę w biznesie dzięki grywalizacji* (e-book), https://gamfi.pl/pl/textpage/grywalizacja-ebook.64.html (accessed on May 25, 2016).

the e-course and, most importantly, be consistent with the main goal of university teaching – the cognitive goal"[23]. Therefore, they will prove useful as a reminder of the most important information from the previous topic, before starting the next one. In addition, they can be used as additional material, briefly introducing issues or concepts mentioned only in the e-learning course, not directly related to the topic of the course. The presence of knowledge pills at the stage of education at the university, as well as the benefits of using them, may encourage students to use this form of teaching also in the future, when they want to learn something about a given topic or simply find a way to solve a problem.

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[23] Ibid.

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Distribution of small batches of knowledge – knowledge pills as tools supporting knowledge management in the opinion of recipients

Abstract

Knowledge pills are a relatively new, fast and effective way of communicating small but properly selected pieces of knowledge on a given topic. Due to the method of sharing, knowledge is delivered when it is most needed. The article will present

considerations on the possibility of using knowledge pills as tools supporting the management of knowledge transfer with the use of materials developed in this form. The article will also show the results of research on knowledge pills carried out among students of senior high school years.

Introduction

Considering the ways of transferring knowledge should begin by defining what is understood by the terms knowledge, information and information society. The term information society was first used by Tadao Umesao in 1963, who used the term in his article to describe an information-based theory of the development of society. The definitions of this concept were defined in many publications, and the issue itself most often required an interdisciplinary approach. According to one of the newer definitions, it is "(…) a society in which information is intensively used in economic, social, cultural and political life; a society that has rich means of communication and information processing, which are the basis for creating most of the national income and providing a source of livelihood for most people (...)"[1]. According to another definition, "(…) the information society is one that uses various types of modern technologies for collecting, analysing and transmitting information. Above all, however, it has the instruments necessary to use these technologies, i.e. knowledge. The widespread use of technology is accompanied by organizational, economic and social changes that affect all spheres of human life and activities"[2].

"The period of dynamic development of a new field began, characterized by numerous technological breakthroughs (transistors in the early 1950s and microprocessors in the early 1970s) and application breakthroughs (personal computers in the 1970s, widespread networking in the 1990s and mobility in the first decade of the 21st century). The growing popularity of ICT applications has increasingly changed social, economic and political structures, creating the reality in which we currently live and which many refer to as the information society"[3]. Access to the Internet, as well as the development of communication possibilities allow for faster and more effective obtaining of information. "Universal access to the

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1 K. Krzysztofek, M.S. Szczepański, *Zrozumieć rozwój. Od społeczeństw tradycyjnych do informacyjnych*, 2nd edition, Wydawnictwo Uniwersytetu Śląskiego, Katowice 2005, p. 170.

2 *Słownik innowacji*, https://www.pi.gov.pl/PARP/chapter_96055.asp?soid=16E5E8C5A59F4CA9817529305A064F5D (accessed on July 7, 2018).

3 M. Goliński, *Społeczeństwo informacyjne – geneza koncepcji i problematyka pomiaru*, Monografie i opracowania, Szkoła Główna Handlowa, Warszawa 2011, No 580, p. 55.

Internet enables communication in the social, cultural and business spheres. By removing time and geographic limitations, it influences the way the enterprise operates. In 2018, the percentage of people using the Internet amounted to 77.5%, i.e. by 1.6 per cent more than in the previous year, while those using it regularly (at least once a week) – 74.8%, i.e. by 2.1 per cent more than in 2017. The percentage of enterprises with broadband Internet access amounted to 95.0%, while those with mobile Internet to 67.6%"[4].

Knowledge and information

The term information, in turn, is very often used interchangeably with the term knowledge. Both terms are difficult to define unequivocally. Information is defined depending on the domain in which the concept is considered. For the purposes of this study, however, the definition will be provided from the point of view of mathematicians and computer scientists. Thus, the information "(...) is a specific intangible good, which, along with the economic progress and the development of means and forms of social communication, becomes more and more important, transforming the face of many traditionally organized economies in the world"[5] or it can be understood as "(...) content taken from the outside world in the process of our adaptation to it and the adaptation of our senses to it"[6].

The definition of the concept of knowledge is no less difficult than that of information, and here also depends on the approach to interpretation and the scientific discipline in which this definition is created. It is true that "knowledge is an inherent, non-material component of our human reality"[7]. But what exactly is it? The technological concept will be discussed here[8] which comes close to the definition of information, but on the other hand it makes possible to evaluate the

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4 *Społeczeństwo informacyjne w Polsce w 2018 r*., https://stat.gov.pl/download/gfx/portalinformacyjny/pl/defaultaktualnosci/5497/2/8/1/spoleczenstwo_informacyjne_w_polsce_w_2018_roku.pdf (accessed on July 7, 2018).

5 E. Niedzielska, *Informatyka ekonomiczna*, [in:] *Economic IT*, E. Niedzielska (ed.), Akademia Ekonomiczna we Wrocławiu, Wrocław 1998, p. 20.

6 N. Wiener, *Cybernetics or Control and Communication in the Animal and the Machine*, The MIT Press and John Wiley & Sons, Inc, New York – London 1954, p. 18.

7 B. Stefanowicz, *Informacja. Wiedza. Mądrość*, vol. 66, Główny Urząd Statystyczny, Warszawa 2013; https://stat.gov.pl/cps/rde/xbcr/gus/OZ_Informacja_Wiedza_Madrosc_180413.pdf (accessed on July 7, 2018).

8 L. Panasiewicz, *Kontrowersje w sprawie zarządzania wiedzą*, "Ekonomika i Organizacja Przedsiębiorstwa", 7, 2004, p. 46.

relationship between these two concepts. Complex information, stored in databases together with complex models allowing for its comprehensive processing and drawing conclusions, constitutes knowledge for the IT approach to knowledge management. It is knowledge expressed and having a specific representation[9].

There are many breakdowns and classifications of knowledge used by organizations, especially enterprises, to help manage this strategic resource. Nevertheless, the most popular division used in knowledge management is the division into explicit and tacit knowledge[10].

"It is assumed that the term information generally means representing the diversity that characterizes the surrounding reality. The basic functions of information include: the ability to transfer knowledge – it is its component, it is a factor determining our actions, it is a culture-forming, opinion-forming, motivational and educational element. Information is also a capital, resource and attribute of knowledge". In considering the data-information-knowledge chain (Figure 1), what is most interesting from the teacher's point of view is knowledge and its appropriate transmission[11].

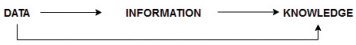

Figure 1. The knowledge chain: relations between data, information and knowledge.
Source: E. Turban, J.E. Aronson, *DSS and Intelligent Systems*, Prentice Hall, New Jersey 2001, p. 349.

In modern economy, the importance of knowledge is constantly growing. Some scholars, raising its importance, refer to it as the "fourth factor of production"[12] and the basis of organizational power. Others, such as I. Nonaka and H. Takeuchi (creators of the concept of an organization that creates knowledge), went a step further, recognizing that knowledge is no longer one of the traditional elements of production (work, capital, land), but becomes the only production factor (resource), which determines the company's competitiveness, thus giving it a chance to survive on the market in the conditions of the global economy[13]. This means the necessity to constantly develop knowledge and

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9 Ibid.

10 K. Perechuda, *Jakościowe kreowanie wiedzy – podejście japońskie*, [in:] *Zarządzanie wiedzą w przedsiębiorstwie*, K. Perechuda (ed.), PWN, Warszawa 2005, p. 45.

11 M. Targaszewska, P. Zając, *Technologie przekazywania informacji na odległość*, http://kwasnicki.prawo.uni.wroc.pl/pliki/Targaszewska%20Zajac%20informacjie%20na%20odlegsc.pdf (accessed on July 7, 2018).

12 C. Sikorski, *Zachowania ludzi w organizacji*, PWN, Warszawa 2001, p. 274.

13 I. Nonaka, H. Takeuchi, *The Knowlegde Creating Company*, Oxford University Press, New York 1995.

raise its level in all entities participating in the "market game" and indicates the growing importance of continuous employee education. The general knowledge of the company is divided and located among all employees and in different groups. However, for it to become productive, it must be managed. In modern organizations, there is a need to create an appropriate knowledge management system[14]. In management theory, there are three leading models of knowledge management: 1) Japanese (I. Nonaka and H. Takeuchi)[15], based on two categories of knowledge: tacit knowledge and formal knowledge, 2) resource model, known as the model of "knowledge sources" (D. Leonard-Barton), 3) process model – extracts knowledge management processes – creation, codification and transfer of knowledge (Figure 2).

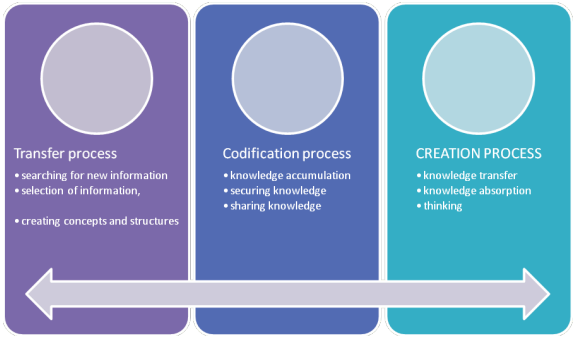

Figure 2. The process of creating, codifying and transferring knowledge.

Source: own study based on: T.H. Davenport, L. Prusak, *Working Knowledge — How Organizations Manage What They Know*, Harvard Business School Press, Boston 1998.

Tools supporting knowledge management

Tools supporting the knowledge management process are subject to constant changes and improvements. The use of modern technologies enables the creation of knowledge, its collection, codification and transfer of knowledge, which is helpful in the implementation of strategic goals adopted by organizations.

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14 E. Skrzypek, *Wpływ zarządzania wiedzą na wartość firmy*, [in:] *Zarządzanie wartością przedsiębiorstwa w warunkach globalizacji*, E. Urbańczyk (ed.), Wydawnictwo Naukowe Uniwersytetu Szczecińskiego, Szczecin 2001, p. 254.

15 I. Nonaka, H. Takeuchi, *Kreowanie wiedzy w organizacji*, Euro management, Poltext, Warszawa 2000, p. 96.

In the literature on the subject, one can encounter various classifications of tools supporting the knowledge management process. Based on the literature review, the table presents a set of equal tools and methods supporting knowledge management systems in organizations.

Table 1. Tools supporting knowledge management in organizations.

Category	Examples
Tools supporting communication, group work and communities of practice (communities of practice)	Groupware (project management systems), workflow, communication channels (e-mail, forum, chat, remote conferences, instant messaging, knowledge networks (collaborative knowledge network, employee knowledge network), newsletters, newsletter)
Tools supporting information resources, the so-called organizational memory (organizational memory)	Repositories (DMS — Document Management System), best practice databases, case bases
Administration, control and monitoring of knowledge management	Knowledge maps, reports on the state of resources and the dynamics of knowledge flow, intellectual capital and others
Remote learning tools – e-learning	LMS platforms, e-learning courses, microcourses, knowlegde pills
Artificial Intelligence Tools	Advanced technology algorithms — statistical, artificial intelligence, data mining

Source: own study based on: W.M. Grudzewski, I.K. Hejduk, *Kreowanie systemów zarządzania wiedzą*, pp. 26–27; S. Łobejko, *Systemy informacyjne w zarządzaniu wiedzą i innowacją*, p. 46.

In times of the pandemic, distance learning tools play a special role. This group of tools deals with the concept of electronic media learning. They are also important due to the aspect of building and measuring the competences of the members of the organization. Tools allowing for quick access to specific portions of knowledge from various devices are becoming more and more important. This role is played by knowledge pills.

Knowledge pills — way to transfer knowledge

One of the ways of transferring knowledge in the form of short but factual batches of material are knowledge pills. It is one of the latest ways of delivering educational content and achieving learning outcomes. Small fragments of knowledge concerning selected fragments of a wider issue are provided in a condensed form. Due to the need to present the most important information in an accessible way, in the form of teaching material, which takes no more than 3–5 minutes to acquire,

the task of developing a knowledge pill becomes extremely difficult. The presented content should be developed in a way that facilitates the assimilation of the content contained therein, therefore the most frequently used are various forms of communication, including films, animations, sounds, material in the form of text, illustrations or charts. Knowledge pills should be available when they are needed most, so they should also be reproducible on commonly used devices. It involves technically adapting the knowledge pills to different reception modes, both on the computer monitor screen and smaller smartphone screens.

There are a few basic rules to keep in mind when creating knowledge pills. First of all, they should be short and concise, but also interesting. They should be designed in such a way to attract the attention of recipients exposed to a huge number of external stimuli. Short, 3–5 minutes long teaching material, designed in a way that will be interesting, dynamic and pleasant to perceive, should meet these requirements. It should be remembered that not the information contained in the pills should facilitate understanding and acquiring knowledge about one selected phenomenon, technology, practical skill. They do not constitute a theoretical interpretation in a given field. When creating, one should remember that the pill is to provide knowledge which topic is the most important, without unnecessary digressions, in the shortest possible form. This is to let you learn its content the first time[16].

The development of knowledge pills should respect the rules of availability[17], and their design should be based on the principles of universal design[18]. Procedural rules relating to digital applications, in particular those made available through applications and websites, may be helpful. WCAG guidelines play a special role in relation to digital content. Web accessibility standards are established by the international Web Consortium (W3C for short). The first version of the guidelines was announced in 1999, and WCAG 2.1 has been in force since June 2018[19].

"Information provided in such small and accessible forms is characteristic of informal learning. However, along with dynamic socio-economic development, these elements should be introduced to formal education. The first steps in this direction are taken by training organizations and project initiatives. Internet

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16 A. Laśkiewicz, *Co to jest micro learning*, https://ipro-elearning.com/html/partners/tech/pigulka_wiedzy_krotko.html (accessed on June 26, 2018).

17 Cf. Convention on the Rights of Persons with Disabilities of October 25, 2012; Act on spatial planning and development of March 27, 2003; Charter of the Rights of Persons with Disabilities, Act of July 19, 2019 on providing accessibility to people with special needs.

18 Universal design means the design of products, environment, programs and services to be usable by all, as far as possible, without the need for adaptation or specialized design; Convention on the Rights of Persons with Disabilities of October 25, 2012.

19 https://www.w3.org/TR/WCAG21/ (accessed on July 7, 2018).

services that allow users to post very short messages using microblogging such as Twitter (tweet is a tweet – sending very short messages of up to 140 characters) are gaining in popularity. Interest in this form of communication can be an interesting alternative in making contact for educational purposes"[20].

Therefore, an attempt was made to check how the knowledge pill provided in formal education at secondary school is assessed by recipients. The study was conducted in the summer semester of the 2018/19 school year. Third-grade students, mostly adults, were included in the study. The questionnaire on the prepared didactic material was completed by 50 out of 70 people. The questionnaire contains questions that allow us to check how this form of developing teaching materials is perceived by young people studying in the secondary school.

The developed knowledge pill concerned the preparation of the game – the submarine, which is in line with the profile of the school. A short theoretical introduction was presented and the program code was discussed step by step, together with the effects to be obtained. The content is a whole and allows you to quickly prepare one game, it contains the necessary components without overly detailed description of each of them.

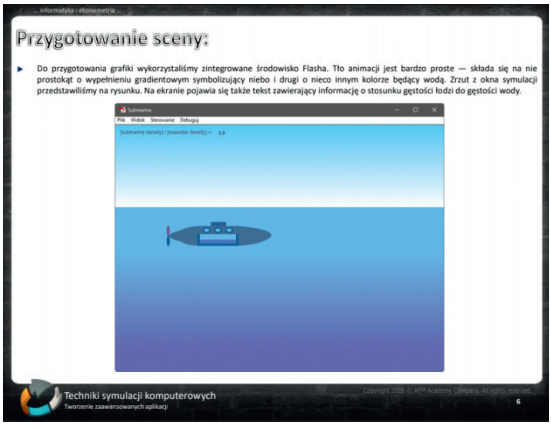

Figure 3. Knowledge pill, screenshot.

[20] D. Dżega, *Metodyka przygotowywania kursów e-learningowych z uwzględnieniem pigułek wiedzy*, http://www.e-edukacja.net/dziewiata/referaty/Sesja_2a_2.pdf (accessed on July 6, 2018).

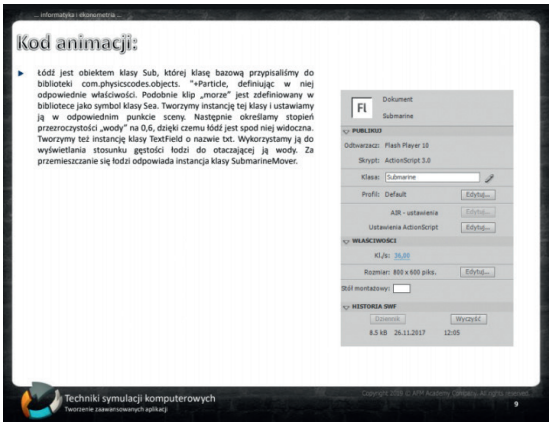

Figure 4. Knowledge pill, screenshot.

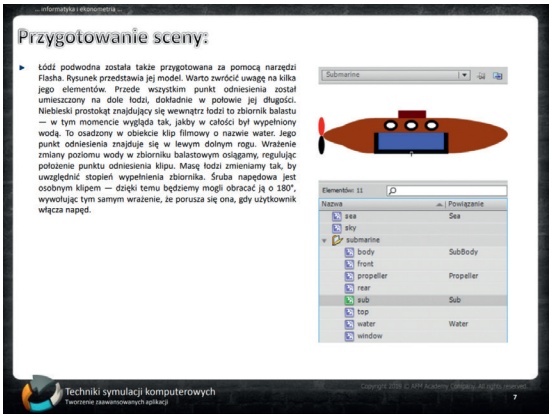

Figure 5. Knowledge pill, screenshot.

The respondents were asked to rewrite the knowledge pill and then answer a few questions. The first was about age and gender. The study covered students in IT classes, the majority of which are boys and the age range is 15–19 years. Due to the low number of responses, the results were presented without using statistical methods.

In the next questions, students were asked to evaluate the teaching materials developed in various forms. On a scale of 1 to 5, they were to assess what form suits them, with 1 being the lowest and 5 the highest.

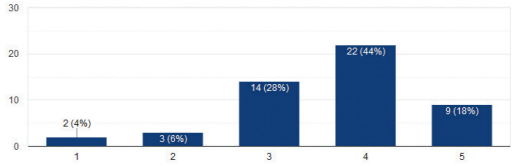

Figure 6. Survey — evaluation of teaching materials in text form (50 answers).

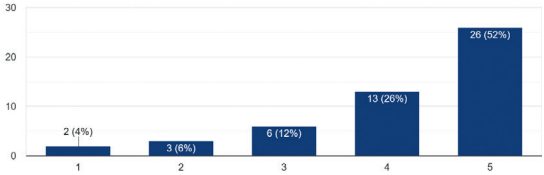

Figure 7. Survey — evaluation of teaching materials in the form of an instructional video (50 answers).

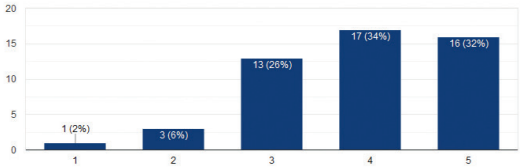

Figure 8. Survey — evaluation of teaching materials in the form of a picture instruction (50 answers).

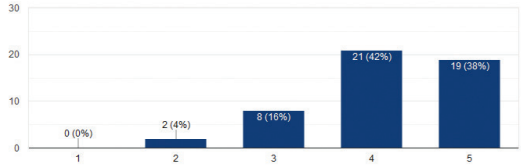

Figure 9. Survey — evaluation of teaching materials in text form (50 answers).

According to the students, the best materials are in the form of an instructional film, while the text instruction is the least popular.

The next series of questions concerned access to teaching materials. The respondents assessed the possibility of accessing didactic materials all the time, the subsequent fragments were made available in batches at the appropriate time, selected by the teacher.

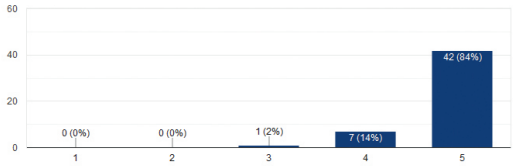

Figure 10. Survey — evaluation of teaching materials, material available at any time (50 answers).

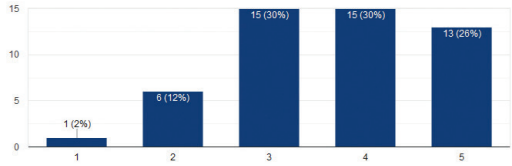

Figure 11. Survey — evaluation of teaching materials — material available at the appointed time (50 answers).

Among the respondents, the management of the teaching material by the teacher and the provision of relevant fragments at the appointed time was good. This allows the acquisition of small parts of knowledge and the progression to the rest of the material in a teacher-controlled manner, and at the same time relieves learners from organizing this process themselves. Nevertheless, the overwhelming majority of students found that it was better for them to have material available all the time. The respondents are high school students, where the teaching process is very organized, managed by the teacher. They have not yet had the opportunity to check what adult self-education is and how important a role in this process is self-discipline and proper time management. Teaching materials and access to them at all times is important and as such has been highly appreciated by them. However, for high school students, accessing and using materials are two different things. Therefore, the assessments of the respondents should be considered in terms of access to materials at all times, on the basis of the possibility of returning to them at any time, and not the possibility of self-education with all responsibility for this process shifted from the teacher to the student.

The next series of questions was to evaluate the work with knowledge pills. The respondents were to assess whether it is an easy, quick and effective way of acquiring knowledge. The study was about one pill of knowledge, therefore opinions are based on one experience. This is especially important when assessing the appearance of the pill – not everyone liked this graphic design.

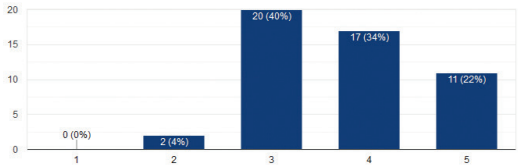

Figure 12. Survey — evaluation of didactic materials — ease of learning (50 answers).

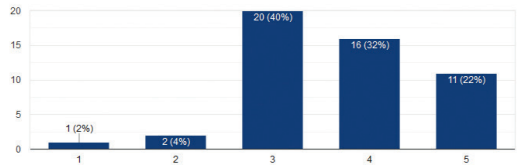

Figure 13. Survey — evaluation of teaching materials — speed of knowledge acquisition (50 answers).

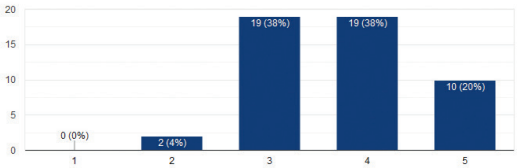

Figure 14. Survey — evaluation of teaching materials — effectiveness of knowledge acquisition (50 answers).

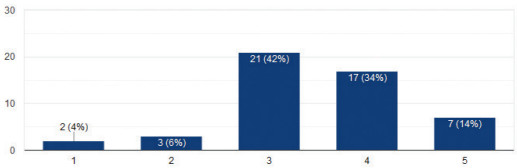

Figure 15. Survey — evaluation of teaching materials — the appearance of the pill (50 answers).

The respondents assessed the knowledge pill prepared for them in terms of effectiveness, ease and speed of acquiring knowledge. The majority of students assessed the knowledge pill as good, but the majority of people rated the effectiveness, speed and ease of learning in this way as average. The same is true of assessing the appearance of the pill.

Later in the questionnaire, the students assessed how the knowledge pills were made available. They themselves had the opportunity to use it as part of the Google Classroom service. Students also have the option of using other e-learning platforms where teaching materials are made available.

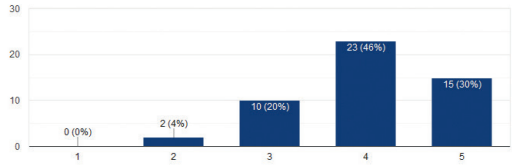

Figure 16. Survey — evaluation of teaching materials — a method of making available on the e-learning platform (50 answers).

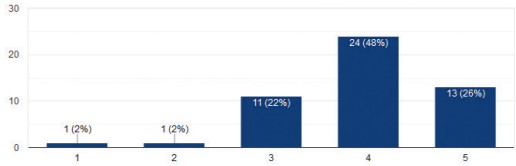

Figure 17. Survey — evaluation of teaching materials — a method of sharing in the form of open resources (50 answers).

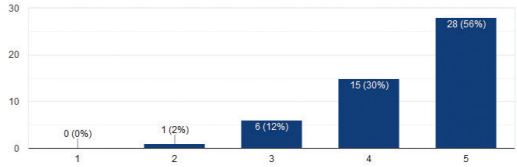

Figure 18. Survey — evaluation of didactic materials — a method of sharing on computers (50 answers).

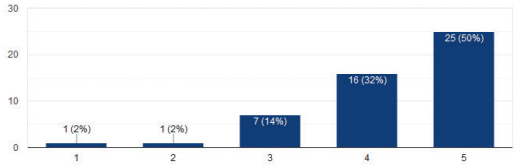

Figure 19. Survey — evaluation of teaching materials — a method of sharing on mobile devices (50 answers).

According to respondents, the best way to share content is the one that allows you to use it on your computer and mobile devices. This should come as no surprise when computers and mobile devices are as natural as being able to breathe for young people.

Conclusions

In the information society, information seems to be the greatest value. Information is a component of knowledge, a factor that determines our behaviour, it is also an opinion-forming, culture-forming, motivational or educational factor. It is also a commodity, capital, resource and attribute of knowledge. Knowledge, in turn, can be passed on in a variety of ways. One of them is knowledge pills. Knowledge pills are one of the newer ways of imparting knowledge. As it turns out, it can also be used in the case of formal education. In this case, it can be used to develop small fragments, tasks to be carried out, aimed at acquiring specific skills. The material in the form of short tasks to be performed with instructions on how to exactly do it allows one to acquire specific skills.

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