

**S. V. OREKHOV, H. V. MALYHON**

## VIRTUAL PROMOTION KNOWLEDGE MANAGEMENT TECHNOLOGY

The article presents a new concept of “Management of knowledge about virtual promotion” on the Internet. Usually a real product or service is being divided into four components (product, price, promotion and place) in accordance with the theory of marketing. One of the components is a product promotion. But now this element is becoming a fully virtual tool. It is necessary to consider product promotion as an image or a copy of a real product in a virtual space that lives in parallel on the network. Therefore, the objective of the paper is the presentation of a new object of research based on the experience of more than thirty real projects performed in Ukraine, USA, Europe and Canada. We regard the promotion as a software product, which works according to principles of knowledge management and machine learning. It is proposed that virtual promotion is characterized by four views: customer or user, data, technology and marketing. Thus, the structure of virtual promotion business process was presented. It includes four steps: selection of hypertext sources, knowledge representation and extraction, semantic kernel building and quality criterion evaluation to stop the process. Based on the process structure the research tasks were identified. The central task is semantic kernel forming. Then the software architecture was developed. IT solution contains CRM system as accounting tool and Web site as an image of virtual promotion. CRM plays main role as a commander center. Here we form semantic kernel and then send it via marketing channels such as Web site, telegram or viber accounts. Another part of IT solution is Web service such as Bing API or Google API. They help us to build the kernel. Also the paper demonstrates the list of future tasks that should be solved and the example of real project of proposed approach.

**Keywords:** Product promotion, CRM, SEO, knowledge management.

**C. B. ОРЕХОВ, Г. В. МАЛИГОН**

## ТЕХНОЛОГІЯ УПРАВЛІННЯ ЗНАННЯМИ ПРО ВІРТУАЛЬНЕ ПРОСУВАННЯ

У статті представлена нова технологія «управління знаннями про віртуальне просування» в мережі Інтернет. Звичайно реальний продукт або послуга характеризуються наступними компонентами: продукт, ціна, просування і місце, згідно з теорією маркетингу. Одним з компонентів є просування товару. Однак зараз цей елемент стає повністю віртуальним інструментом. Необхідно розглядати просування продукту як відображення або копію реального продукту у віртуальному просторі. Це відображення існує паралельно у мережі та безпосередньо впливає на реальний продукт чи послугу. Тому ціллю статті є презентація нового об'єкта дослідження, поява якого основана на досвіді виконання більш ніж тридцяти реальних проектів в Україні, США, Європі та Канаді. Ми працюємо відповідно до принципів управління знаннями і машинного навчання. Передбачається, що віртуальне просування характеризується чотирма репрезентаціями: клієнт або користувач, дані, технологія та маркетинг. Далі була представлена структура бізнес-процесу віртуального просування. Він включає чотири етапи: вибір джерел гіпертексту, подання та витяг знань, побудова семантичного ядра і оцінка критерію якості для зупинки процесу. На основі структури процесу були визначені задачі дослідження. Центральна задача – формування семантичного ядра. Потім була розроблена архітектура програмного забезпечення. ІТ рішення містить CRM систему в якості інструменту обліку та Веб сайт як образ віртуального просування. CRM грає роль командного центру. Тут формується семантичне ядро і потім відправляється через маркетингові канали, такі як Веб сайт, Телеграм канали або профілі в Вайбері. Інша частина ІТ рішення – це Веб сервіс, такий як Bing API або Google API. Вони допомагають нам побудувати ядро. Також в статті наведено список майбутніх завдань, які необхідно вирішити, і приклад реальних проектів в рамках запропонованого підходу.

**Ключові слова:** Просування продукту, CRM, SEO, управління знаннями.

**C. B. ОРЕХОВ, Г. В. МАЛИГОН**

## ТЕХНОЛОГІЯ УПРАВЛІННЯ ЗНАННЯМИ О ВІРТУАЛЬНОМ ПРОДВИЖЕННІ

В статье представлена новая технология «управление знаниями о виртуальном продвижении» в среде Интернет. Обычно реальный продукт или услуга характеризуются четырьмя компонентами (продукт, цена, продвижение и место) в соответствии с теорией маркетинга. Одним из компонентов является продвижение товара. Однако сейчас этот элемент становится полностью виртуальным инструментом. Необходимо рассматривать продвижение продукта как отображение или копию реального продукта в виртуальном пространстве. Это отражение существует параллельно в сети и непосредственно влияет на реальный продукт или услугу. Поэтому целью статьи является презентация нового объекта исследования, основанного на опыте более тридцати реальных проектов, выполненных в Украине, США, Европе и Канаде. Мы рассматриваем продвижение как программный продукт, который работает в соответствии с принципами управления знаниями и машинного обучения. Предполагается, что виртуальное продвижение характеризуется четырьмя репрезентациями: клиент или пользователь, данные, технологии и маркетинг. Далее была представлена структура бизнес-процесса виртуального продвижения. Он включает четыре этапа: выбор источников гипертекста, представление и извлечение знаний, построение семантического ядра и оценка критерия качества для остановки процесса. На основе структуры процесса были определены задачи исследования. Центральная задача – формирование семантического ядра. Затем была разработана архитектура программного обеспечения. ИТ решение содержит CRM систему в качестве инструмента учета и Веб сайт как образ виртуального продвижения. CRM играет главную роль командного центра. Здесь мы формируем семантическое ядро и затем отправляем его через маркетинговые каналы, такие как Веб сайт, Телеграм каналы или профили в Вайбере. Другая часть ИТ решения – это Веб сервис, такой как Bing API или Google API. Они помогают нам построить ядро. Также в статье приведен список будущих задач, которые необходимо решить, и пример реальных проектов в рамках предложенного подхода.

**Ключевые слова:** Продвижение продукта, CRM, SEO, управление знаниями.

### Introduction: Problem and Research Goals.

During last ten years more than thirty different projects in the fields of CRM, SEO [1–2], software engineering, start-up building were performed. The application areas were pharmaceutical marketing process, wood selling, drug production and selling, jewelry production and selling,

market research business, online e-commerce, auto-parts selling etc. All projects have the same element – online selling process. The main distinguishing features of this process are that it runs on the Internet and, as a rule, in automatic mode. That is, it is autonomous and as integrated as possible with other processes such as finance (contracts

and payments) and delivery (accounting and warehousing of goods). In other words, we are moving to the level of interaction between business units, which are represented by various autonomous software systems. These software systems can work both on a single platform and outside it. Only formats and data transmission channels are consistent (data integration). Further development of this situation leads to the emergence of separate software modules – intelligent agents. Each agent performs a specific list of tasks (not just functions). That is, it incorporates a set of algorithms (knowledge), which potentially can be changed, improved. These changes are made by the developer on the instructions of the customer.

The results obtained were not something new, because a study of IT development trends over the past thirty years clearly indicates the following features. First, as was shown by the results of the CRM project from IBM, the reason of the interaction between the client and the supplier of the product or service has been changed. The main goal of this interaction is to transfer unique knowledge from the supplier to the client, which he can use to meet his needs, fig. 1, a.

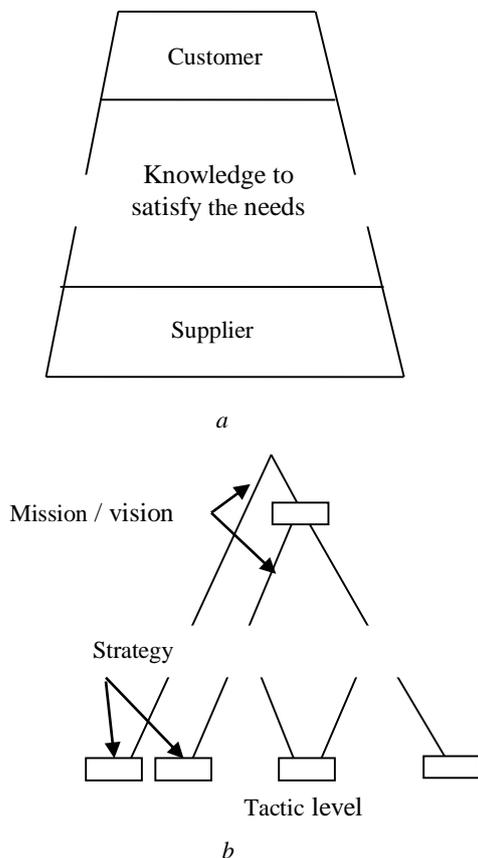


Fig. 1. CRM project conclusions

As a result, a new vision is formed: the pyramid of needs is replaced by a pyramid of knowledge (fig. 1, b). It includes three levels: vision or mission, strategy (algorithms) and tactics (technologies). To control such a pyramid, it is necessary to use modern software.

The supplier forms a pyramid of knowledge that must be managed. In addition, part of this knowledge is

transferred to the client along with the real product. Thus, part of the supplier's knowledge is separated from the business system and placed on the Internet. We will call this part of knowledge "virtual promotion" (VP). In the literature this effect was registered at first as paradigm of WEB 1.0 – 2.0, when a business develops WEB site to promote its product or service [3–4].

Virtual promotion (VP) characterizes by four views: user, data, technology and marketing (fig. 2). The end user, in order to gain knowledge hidden in virtual promotion, is faced with one of four virtual views: a web page, a profile on a social media, a video clip or a telegram channels. These tools operate on data in three main formats. These formats contain links and keywords to put everything together.

Next view is involved in four core technologies. Marketing representation only captures the final desires of the client and supplier. Be the first in search of a server, so in the mind of client. This primary condition is reinforced by quality factors for SWEBOK model [5]. This is not predetermined. The client expects and seeks knowledge. Therefore, they must be managed.

Let us formulate the definition of a new research object "virtual promotion" and its characteristics. Firstly, the purpose of the functioning of this object is to ensure the quick and effective appearance of information about the product or service in the minds of potential customers. Such an appearance will be effective if, in response to a query from a search server or search engine on a social network, product information was in first place (first page in a response to a search query).

Secondly, the structure of virtual promotion is a combination of knowledge in the field of marketing and software engineering. Such a body of knowledge is capable of accumulating, storing and transmitting only information technology. Consequently, virtual promotion is a technology based on software or artifacts that describe the software development process. Thus, it is possible to apply software engineering and its methods to virtual promotion.

Then, thirdly, the parameters of virtual promotion become factors, criteria and metrics of software quality (SWEBOK), as well as metrics of marketing activities [6].

Fourth, the synergistic effect of the new technology is based on the application of knowledge management methods and Internet technologies [7].

Fifth, VP exists in parallel mode with the real product or service. Thus, we develop it as we do it with software, for example.

**Problem statement.** The main problems of virtual promotion functionality are:

*Incomplete information.* VP is based on the idea that the information about a product should be on the first position. But what kind of data we have as input and output.

At the moment, we regard as output the list of links generated by search engine and believe that would be enough to reach our preliminary goal in term of marketing. As input we consider the combination of hypertext, videos and images stored in Internet. In general, this hypertext describes the knowledge how a user satisfies some need using a product or service. Also user is interested in the quality of product or service if he (she) buys it. It is

necessary to know the price of possession of a product. And so on. On the other hand, the volume of hypertext is restricted by communication channel. The channel is being built between a user and VP via search engine. Usually user is not ready to read all texts fully.

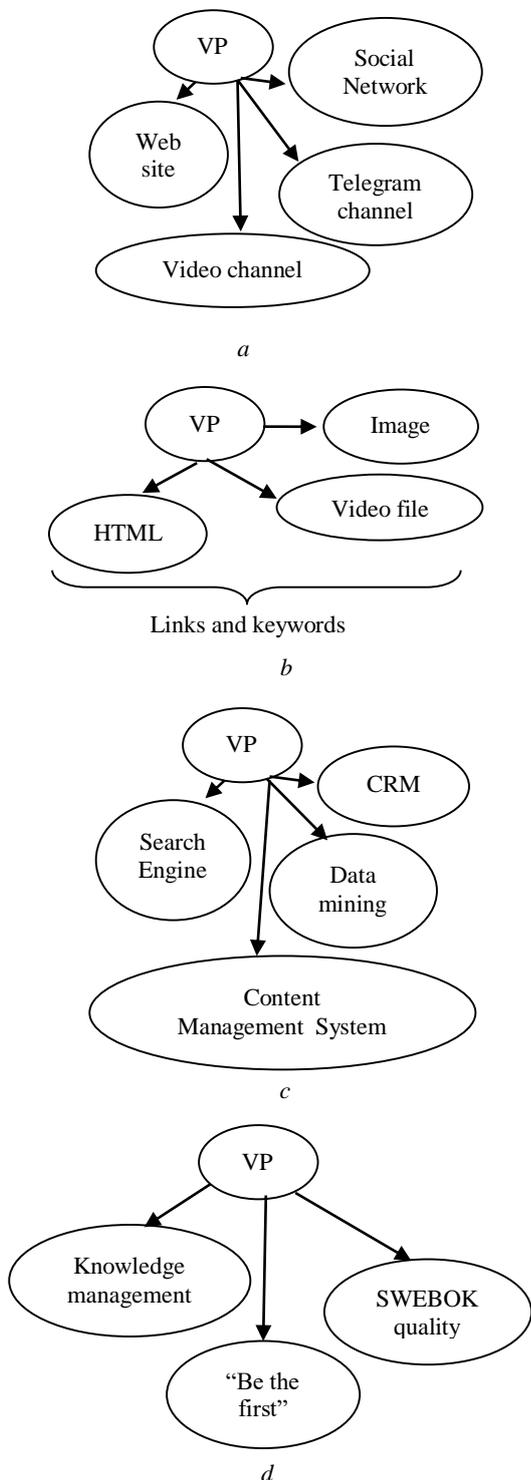


Fig. 2. VP views

*Unstable structure.* This is a new research object. Therefore, there is not a stable structure of such technology or its definition till this moment. Each business tries to build at will. As a result we have a black box (fig. 3);

*Uncertain metrics.* First of all, we should establish a relationship between the first positions in the search and sales. This connection provides a criterion according to which virtual promotion should be considered as effective

Since 2009, a study of virtual promotion has been carried out in more than 30 projects in Ukraine, USA, Europe and Canada. This study was carried out as part of the BINTECO startup. This study shows that virtual promotion is an independent object, or rather the field of knowledge of the enterprise, which it is ready to share with potential customers. That is, virtual promotion is corporate knowledge that the company is ready to transfer to the client using open communication channels so that the latter can make a decision on the purchase of a product or service. This is the link between corporate knowledge and customer needs.

Then the goal of managing virtual promotion is to increase the efficiency of enterprise sales based on Internet technologies and knowledge management. By structure, virtual promotion is a component of the sales process. As we know according to knowledge management theory sales process includes the following steps: order processing, delivery and analysis. We propose to consider the process as follows, fig. 3. First stage is text processing to extract necessary knowledge in a form of semantic kernel. On the next step we provide search engine optimization activity to attract potential clients to retrieve our knowledge. Finally we analyze the position in search list according to predefined criteria of quality.

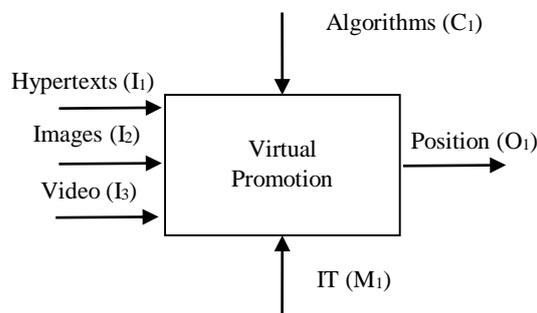


Fig. 3. VP black box

Based on the analysis of VP business process the following tasks were selected:

*Choose the sources of hypertexts.* At the moment we have the following hypertext sources: Google news, web page, social network page, telegram (viber) stream. These sources were selected because it is possible to extract the text automatically.

*Knowledge representation and extraction.* Next task is how to represent VP knowledge and then extract it from selected source automatically. One of the best way to represent is a semantic net;

*Semantic kernel building.* Therefore, it is necessary to build special semantic net to describe VP knowledge. This net is named semantic kernel [1]. It is convenient form for further SEO process.

*Software architecture selection.* To support the business process performance the special software should

be developed. The software architecture is based on the technologies, methods and algorithms mentioned above.

*Quality criteria selection and analysis.* Finally, we should evaluate the efficiency of our business process in term of income, time and customer satisfaction.

Thus, a new object of study is highlighted – virtual promotion. This object is characterized by the following goal: to increase sales efficiency. Structurally, virtual promotion is part of the sales process. Fig. 4 shows the business process of virtual promotion, which allowed us to identify five tasks for solution. In addition, virtual promotion is characterized by input parameters (hypertext from open sources and sources within the enterprise). The output parameters are the position in the search list and the quality criteria similar to the software quality criteria. This is due to the fact that, according to the business process scheme, its components are information technologies implemented by various software. Therefore, we will consider virtual promotion as some kind of software that has its own development and implementation cycle.

Consider an example of the implementation of such software for a real company in Ukraine

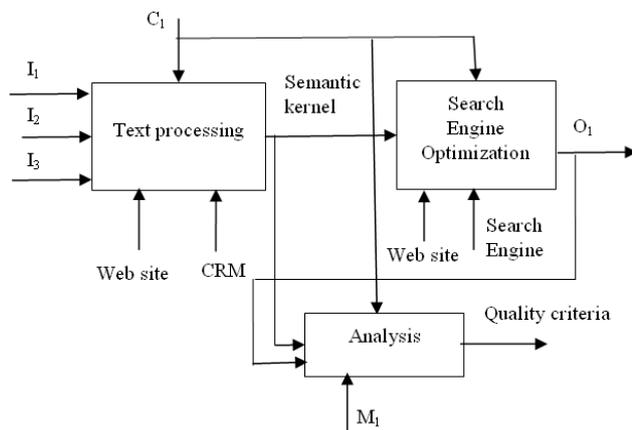


Fig. 4. VP business process

**Solution.** We assume that it is required to increase the efficiency of the sales process of a company that sells lumber. The standard distribution channels for lumber are shops, construction companies, and just citizens. Information channels for such a product are the Internet, rumors, recommendations and announcements in the newspaper. We assume that the main channel is the Internet. Then our task is to develop special software that visualizes knowledge about lumber (grade, dimensions, price, location, scope) on the first page in the search.

To implement VP business process, it was proposed to develop CRM system and WEB site. CRM system plays role of accounting for lumber in a warehouse, accounting for the process of interaction with customers, pricing policy, storage of description of lumber. But its main function, using the semantic kernel formation algorithm [1], is to form the last. Then the formed core is placed on the pages of the WEB site and the optimization process starts.

Software architecture of such IT solution is shown in fig. 5.

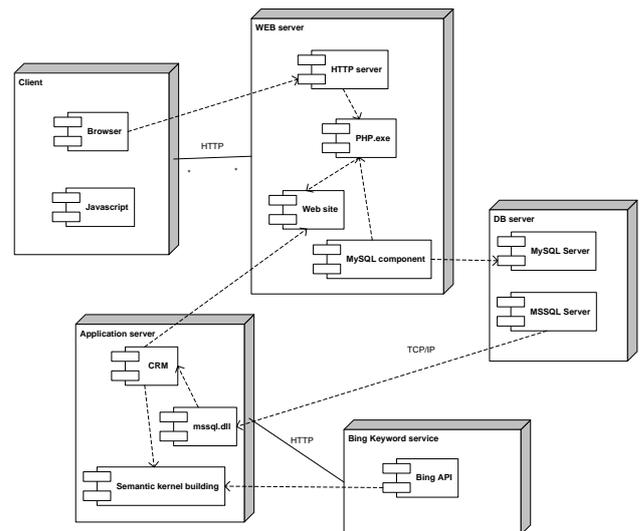


Fig. 5. Software architecture

An interesting point of this project was the fact that there were about five WEB sites that work with this CRM system. This made it possible to fill the first page of the search, which also guaranteed an increase in sales. Each WEB site has got personal semantic kernel.

**Results.** Over the course of ten years, more than thirty projects have been completed, the results of which confirmed the presence of a new research object – virtual promotion. Projects have been completed in the following application areas: marketing, lumber sales, cosmetics, auto spare parts sales, construction materials, metal-plastic windows, jewelry production [10–12].

All completed projects included architectural solution, software and organizational measures according to the ideology of knowledge management.

**Summary.** The performed scientific work allowed us to get some interesting results. The project presented in the field of lumber showed sales growth for the first year of implementation of 100%. Similar achievements were obtained for other projects. Now the share of virtual advancement in the business of this company is about 70%. The average time to go to the first page and get the first significant effect of virtual promotion is 3–4 months. All projects were carried out in different application areas, which prove the reliability of the proposed approach. All virtual promotions are available online.

**Список литературы**

1. Michael Godlevsky, Sergey Orekhov, Elena Orekhova. Theoretical Fundamentals of Search Engine Optimization Based on Machine Learning. *CEUR-WS. CIIIA*. 2017. № 1844, P. 23–32.
2. Sergey Orekhov, Henadii Malyhon, Irina Liutenko, Tetiana Goncharenko. Using Internet News Flows as Marketing Data Component. *CEUR-WS. CIIIA*. 2020. № 2604. P. 358–373.
3. Amy Shuen. *Web 2.0: A Strategy Guide: Business thinking and strategies behind*. CIIIA, O'Reilly Media, Inc., 2008. 266 p.
4. Ries, A. and Trout, J. *Positioning, The battle for your mind*. New York: McGraw-Hill Inc., 2001. 228 c.
5. Pierre Bourque, Richard E. SWEBOK. *Guide to the Software Engineering Body of Knowledge. Version 3.0*. CIIIA: IEEE Computer Society, 2014. 704 p.
6. Kotler F. *A Framework for Marketing Management*. CIIIA: Prentice-Hall Inc., 2001. 456 p.

7. Kotler F. Marketing Management. США: Pearson Education, 2009. 889 p.
8. Definitive Guide to Marketing Metrics and Analysis. США: Marketo Publ., 2011. 70 p.
9. Paine K. Introduction: The Evolution of Media Measurement. США: CyberAlert LLC Publ., 2014. 75 p.
10. Cherenkov I, Orekhov S. News data mining based on example of polymer market. *Information Processing Systems*. 2012. № 9 (107), P. 224–227.
11. Cherenkov I, Orekhov S. Approach for extracting events from news stream. *Eastern-European Journal of Enterprise Technologies*. 2013. Vol. 1, № 4 (61). P. 62–64.
12. Maryin I., Orekhov S. Overdraft agreement processing based on XML and its implementation in bank information system. Bonn: Gesellschaft für Informatik e.V. Publ., 2003. P. 121–130.
4. Ries, A. and Trout, J. Positioning, The battle for your mind. New York: McGraw-Hill Inc., 2001. 228 p.
5. Pierre Bourque, Richard E. SWEBOK. Guide to the Software Engineering Body of Knowledge. Version 3.0. USA: IEEE Computer Society Publ., 2014. 704 p.
6. Kotler F. A Framework for Marketing Management. USA: Prentice–Hall Inc., 2001. 456 p.
7. Kotler F. Marketing Management. USA: Pearson Education, 2009. 889 p.
8. Definitive Guide to Marketing Metrics and Analysis. USA: Marketo Publ., 2011. 70 p.
9. Paine K. Introduction: The Evolution of Media Measurement. USA: CyberAlert LLC Publ., 2014. 75 p.
10. Cherenkov I, Orekhov S. News data mining based on example of polymer market. *Information Processing Systems*. 2012, vol. 9 (107), pp. 224–227.
11. Cherenkov I, Orekhov S. Approach for extracting events from news stream. *Eastern-European Journal of Enterprise Technologies*. 2013, vol. 1, no. 4 (61), pp. 62–64.
12. Maryin I., Orekhov S. Overdraft agreement processing based on XML and its implementation in bank information system. Bonn: Gesellschaft für Informatik e.V. Publ., 2003, pp. 121–130.

#### References (transliterated)

1. Michael Godlevsky, Sergey Orekhov, Elena Orekhova. Theoretical Fundamentals of Search Engine Optimization Based on Machine Learning. *CEUR WS*. USA. 2017, vol. 1844, pp. 23–32.
2. Sergey Orekhov, Henadii Malyhon, Irina Liutenko, Tetiana Goncharenko. Using Internet News Flows as Marketing Data Component. *CEUR WS*. USA. 2020, vol. 2604, pp. 358–373.
3. Amy Shuen. Web 2.0: A Strategy Guide: Business thinking and strategies behind. USA: O'Reilly Media, Inc., 2008. 266 p.

4. Ries, A. and Trout, J. Positioning, The battle for your mind. New York: McGraw-Hill Inc., 2001. 228 p.
5. Pierre Bourque, Richard E. SWEBOK. Guide to the Software Engineering Body of Knowledge. Version 3.0. USA: IEEE Computer Society Publ., 2014. 704 p.
6. Kotler F. A Framework for Marketing Management. USA: Prentice–Hall Inc., 2001. 456 p.
7. Kotler F. Marketing Management. USA: Pearson Education, 2009. 889 p.
8. Definitive Guide to Marketing Metrics and Analysis. USA: Marketo Publ., 2011. 70 p.
9. Paine K. Introduction: The Evolution of Media Measurement. USA: CyberAlert LLC Publ., 2014. 75 p.
10. Cherenkov I, Orekhov S. News data mining based on example of polymer market. *Information Processing Systems*. 2012, vol. 9 (107), pp. 224–227.
11. Cherenkov I, Orekhov S. Approach for extracting events from news stream. *Eastern-European Journal of Enterprise Technologies*. 2013, vol. 1, no. 4 (61), pp. 62–64.
12. Maryin I., Orekhov S. Overdraft agreement processing based on XML and its implementation in bank information system. Bonn: Gesellschaft für Informatik e.V. Publ., 2003, pp. 121–130.

Поступила (received) 16.05.2020

#### Відомості про авторів / Сведения об авторах / About the Authors

**Орехов Сергій Валерійович** – кандидат технічних наук, доцент, Національний технічний університет «Харківський політехнічний інститут», доцент кафедри програмної інженерії та інформаційних технологій управління; м. Харків, Україна; ORCID: <https://orcid.org/0000-0002-5040-5861>; e-mail: [sergey.v.orekhov@gmail.com](mailto:sergey.v.orekhov@gmail.com)

**Малигон Геннадій Васильович** – Національний технічний університет «Харківський політехнічний інститут», аспірант кафедри програмної інженерії та інформаційних технологій управління; м. Харків, Україна; ORCID: <https://orcid.org/0000-0001-5448-2488>; тел.: (057) 707-64-74; e-mail: [gmalygon@gmail.com](mailto:gmalygon@gmail.com)

**Орехов Сергей Валерьевич** – кандидат технических наук, доцент, Национальный технический университет «Харьковский политехнический институт», доцент кафедры программной инженерии та информационных технологий управления; Харьков, Украина; ORCID: <https://orcid.org/0000-0002-5040-5861>; e-mail: [sergey.v.orekhov@gmail.com](mailto:sergey.v.orekhov@gmail.com)

**Малыгон Геннадий Васильевич** – Национальный технический университет «Харьковский политехнический институт», аспирант кафедры программной инженерии та информационных технологий управления; Харьков, Украина; ORCID: <https://orcid.org/0000-0001-5448-2488>; тел.: (057) 707-64-74; e-mail: [gmalygon@gmail.com](mailto:gmalygon@gmail.com)

**Orekhov Sergey Valerievich** – PhD, Associate Professor, National Technical University «Kharkov Polytechnical Institute», Associate Professor of Software Engineering and Management Information Technologies department; Kharkov, Ukraine; ORCID: <https://orcid.org/0000-0002-5040-5861>; e-mail: [sergey.v.orekhov@gmail.com](mailto:sergey.v.orekhov@gmail.com)

**Malyhon Hennadiy Vasilievich** – National Technical University «Kharkov Polytechnical Institute», Post graduate of Software Engineering and Management Information Technologies department; Kharkov, Ukraine; ORCID: <https://orcid.org/0000-0001-5448-2488>; тел.: (057) 707-64-74; e-mail: [gmalygon@gmail.com](mailto:gmalygon@gmail.com)