

AN ASSESSMENT OF INFORMATION SYSTEMS FOR THE INDEXATION AND ANALYSIS OF ONLINE PUBLICATIONS

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Abstract: The article studies the methodological issues related to assessing the information systems for the indexation and analysis of information available on the Internet. The comparative analysis of such information systems can be performed only after we define in advance assessment indicators and experts determine their levels of significance (weighted coefficients) in addition to providing access to the necessary data sources. In this research, the latter are represented by a number of Internet resources, which provide characteristics and information about the architecture solutions effective on the market nowadays. As a result of the determined weaknesses and disadvantages of the implemented systems, the last part of the research offers a concept for the development of a similar information system. Based on this, the article outlines the advantages of this concept in comparison with the existing alternative solutions.

Key words: assessment of information systems, online publications, indexation of information

JEL: C8, L86.

Introduction

A large amount of the information used currently throughout the world could be found mainly in the online environment in the form of various publications. The most significant ones usually appear as:

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- Publications in news web portals;
- Blog publications;
- Comments in web forum threads;
- Comments to news in specialized news web sites.

There are a number of information systems that index the information available on the Internet in one of the listed types of publications. Some of these systems also make attempts to analyse adequately the indexed information so that it can be useful for the managerial staff of companies operating in various business sectors. With reference to this, the objective of the article is to perform the following sequence of tasks:

- Outlining the theoretical principles of the information systems used for the indexation and analysis of Internet publications;
- Determining the indicators for assessing the information systems used for the indexation and analysis of Internet publications;
- Selecting a number of popular information systems used for the indexation and analysis of Internet publications for the purposes of the study and performing a comparative analysis;
- Offering a concept of an information system for the indexation and analysis of online publications.

The completion of these tasks creates opportunities for developing a concept of an information system, which analyses the information retrieved from online publications. With reference to this, the study deals with the information systems for the indexation and analysis of online publications to assess their functionality. The purpose of the present study is to research the methodological issues related to performing a comparative analysis of the information systems and the main characteristics of the leading software applications. Another objective of the study is to evaluate the information systems for the indexation and analysis of online publications. The main focus of the article will be on finding opportunities for formulating suggestions for configuring an information system for the indexation and analysis of online publications.

1. Theoretical concepts of information systems for the indexation and analysis of online publications

There is no single answer to the question of what a system is because of the wide variety of systems and their specific characteristics that depend on the area, in which they are studied. However, for the purposes of the study and based on the fact that it researches information systems, this article adopts a working definition that clearly describes these systems. According to this explanation, a system is every combination of elements that functions as a whole in order to achieve a particular goal. It involves the relations between the system elements and their connection with the environment as well as the properties of the elements and the relations². The elements of a system are determined by its functions, nature and properties. However, certain elements are common for all types of systems. Every system has an input/ entrance, output/ exit and processes that take place inside it. What is more, every system serves particular purposes and in order for them to be accomplished there should be strict control. The control is exercised based on received information. It provides feedback, which is compared to the goals of the system. If there are discrepancies, control is imposed on the entrance of the system. Other elements of the system are its boundaries and the environment. With some systems, they are clearly outlined while with others they are rather blurred and are subject to subjective evaluation. One more element of systems are the relations within them. They are of key importance because they form the integrity of the system and the interaction between its elements. With reference to this, the information system is a subsystem of the business organization system and according to some authors nowadays, there are almost no factories, companies or corporations, which do not use computer information systems and networks for the automated processing of business data and facilitating the management of their business processes³. There are different definitions of an information system. The

² **Motsev**, M. Informatsonni sistemi v biznesa. UI Stopanstvo, S., 1997.

³ **Varbanov**, R. i kol. Biznes informatika. Faber, 2009.

term itself has changed over the years due to the rapid development of the technologies. For some authors this is a combination of interrelated components functioning as a unified whole for collecting, extracting, processing, storing and transferring information for the purposes of planning, coordinating, controlling and decision making in the organization⁴. In this case, the emphasis is on the three operations, which determine the functions of information systems, i.e. inputting, processing and outputting data. Other sources focus on the other aspects of the information systems when defining them. According to them, the information system is a combination of information technologies and the activities of the people, who apply them to manage processes, make decisions, etc. with the help of computer systems⁵. The purpose of the system is to be used by organizations or individuals so that they can store databases, and manage and process the entire information or parts of it. There are different information systems, e.g. financial, geographical, industrial, etc. In general, information systems can be divided into systems for performing a particular operation (processing of transactions, for example) and systems for collecting data needed for making decisions. Some authors combine the two above-mentioned definitions of an information system by providing a new one, which is more accurate and comprehensive. According to it, the information system collects, processes, stores, analyses and distributes information with a particular purpose. Like any other system, the information system involves input data (instructions) and output data (reports, calculations). The system processes the input data and generates output results, which are sent to users or other systems. The information system may also include a feedback mechanism and, similar to all other systems, it functions within the framework of its environment⁶. This study

⁴ **Motsev**, M. Informatsionni sistemi v biznesa. S., UI Stopanstvo, 1997.

⁵ Informatsionna sistema, 12.07.2016,

https://bg.wikipedia.org/wiki/%D0%98%D0%BD%D1%84%D0%BE%D1%80%D0%BC%D0%B0%D1%86%D0%B8%D0%BE%D0%BD%D0%BD%D0%B8_%D1%81%D0%B8%D1%81%D1%82%D0%B5%D0%BC%D0%B8

⁶ **Stefanova**, K. Upravlenski informatsionni sistemi: Aspekti na funktsionirane i proektirane. Sofia, Avangard Prima, 2006.

will use this definition of an information system. Based on the reviewed definitions, it can be concluded that the information systems are a collection of people, technologies and organisations, whose goal is to take certain input data, to process them and, as a result, to provide information for their users. Moreover, information systems are becoming an important element of organisations and their successful management. With reference to this, it is important to take into account the fact that the majority of the information nowadays is published on the Internet. In the today's virtual world, there are millions of web sites containing different information. Even if we imagine that the information on all websites is the same, it would certainly be presented on them in a different way from a structural point of view. The reasons for these differences could be numerous. On one hand, the websites could have a specific design. On the other hand, the possibility of realising a single design differently in the client web language by the websites' developers always exists. In a number of cases there are also errors in the structuring of the information on various websites resulting from accidental mistakes made by the developers. The majority of modern browsers have tools for eliminating these errors so that the web content is well presented and visualised. With reference to this, this article uses the following definition of an information system for the indexation and analysis of online publications: a system, which permits the analysis and retrieval of web content in a structured manner regardless of differences in the visualization and possible errors in the structuring of different websites. As a rule, these systems index the entire content on the client web pages. The standard scheme for retrieving web content involves the following steps:

- Accessing the web page;
- Retrieving the entire content as HTML code;
- Separating the text from the HTML code to perform the next operations (indexation and analysis).

2. Comparative analysis of information systems for the indexation and analysis of online publications

Throughout the world, there are numerous studies of the issues related to indexing information on the Internet, implementing software, assessing the risks of implementing software and measuring the effectiveness of different IT solutions.

Our understanding is that the comparative analysis of such software solutions must be conducted by following these steps:

- **Defining the scope of the comparative analysis.** At this stage, it is necessary to determine the scope of the analysis. In this particular case the comparative analysis will deal with studying and comparing the characteristics of different software applications for information indexation used by leading companies;

- **Determining the indicators use in the analysis.** This stage is one of the most important ones for conducting the comparative analysis. The indicators that will be used in the comparison have to reflect the purpose of the analysis, for example, when several software products are compared to determine their strengths and weaknesses and the possibilities for entering new markets or using alternative software products. We think that the formulation of the indicators used in the comparative analysis should precede the description and analysis of the software;

- **Developing a system of weighted coefficients.** If the findings of the comparative analysis are used for a SWAT analysis of the studied computer information systems, it is necessary to develop a system of weighted coefficients for each indicator. This can be done in a number of different ways but the purpose has to be to reduce subjectivity as much as possible;

- **Studying the characteristics of the compared software products.** At this stage, it is necessary to thoroughly analyse the functionality, usage and capabilities of the compared products. This stage follows the definition of the indicators used in the comparison, therefore the performed analysis should be consistent and focused on achieving the set goals;

- **Performing the comparative analysis.** The main task at this stage is to determine the strengths, weaknesses, opportunities and threats for each of the analysed software products, i.e. carrying out a SWAT analysis. The elements of the analysis are outlined with reference to the specifics of the performed comparative analysis.

For the purposes of the present study, the system of weighted coefficients is determined by following these steps:

- Developing a questionnaire for determining the weight of the comparative analysis indicators. The first step is to develop a questionnaire for determining the level of significance of each indicator. With its help, each expert ranks the indicators, i.e. they determine which one is more important and less important with reference to the goals of the analysis;

- Selecting the experts. These are specialists in the field of indexing information who are familiar with the analysed processes, law regulations, IT practices and other specifics;

- Completing the questionnaires for determining the weighted coefficients is done by interviewing each expert;

- Determining the system of weighted coefficients is done by weighted average calculation of the significance degrees given by each expert and the relative share of the expert in the system;

- The obtained weighted coefficients of the indicators are used to form the overall system.

To carry out the comparative analysis by applying the method of giving evaluation points, each indicator is given a certain number of points from 0 to 100 depending on its importance and type. The calculation of the resulting value can be done in one of the two methods:

- Calculation of the mean value. According to this method, the points given to all indicators are summed and then divided by the number of the indicators. The main advantage of this approach is that it does not require the formation of systems of weighted coefficients. Its main disadvantage, however, is that it neglects the more important indicators at the expense of the less important ones due to lack of weights;

- Calculation of the weighted average. According to this method, the points given to each indicator are multiplied by the weighted

coefficient of the indicator and are summed. The main advantage of this approach is that it provides an opportunity for determining the degree of importance of each indicator through the value of its weighted coefficient. The main disadvantage, however, is the need of creating a system of weighted coefficients.

The indicators used in the comparative analysis are determined after studying the capabilities of the software solutions for the indexation and analysis of online publications and the requirements for managing the use of such information systems. The selected indicators are as follows:

- Accurate data categorization;
- Ease of use of the application;
- Data indexation capability in different languages;
- Certain level of qualifications required from the people working with the application (business analysts);
- High frequency data updating;
- Large volume of indexed data;
- Output of similar results;
- Results filtering capability according to date or period;
- Navigation through the user interface;
- Simple and complex search capability;
- Priority output of popular results;
- Specialized algorithms for particular groups of web sources.

To rank the indicators according to their significance, we proceed to determining the system of weighted coefficients, which has been done following the above – described steps. 10 experts have taken part in the process of determining the degree of significance. Their assessments are presented in Table 1.

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Table 1.
Expert assessments of the significance degrees of the indicators used in the comparative analysis

	Accurate data categorization	Ease of use of the application	Data indexing capability in different languages	Certain level of qualifications required from the people working with the application	High frequency data updating	Large volume of indexed data	Output of similar results	Results filtering capability according to date or period	Navigation through the user interface	Simple and complex search capability	Priority output of popular results	Specialized algorithms for particular groups of web sources
Expert 1	92	67	25	75	100	83	42	33	17	50	8	58
Expert 2	92	75	25	58	100	83	33	42	8	50	17	67
Expert 3	83	75	17	58	100	92	42	50	25	33	8	67
Expert 4	92	75	25	67	83	100	42	33	8	50	17	58
Expert 5	100	75	25	67	83	92	33	50	8	42	17	58
Expert 6	100	67	25	75	83	92	33	42	17	50	8	58
Expert 7	92	75	8	58	100	83	33	42	17	50	25	67
Expert 8	92	75	17	67	100	83	42	33	8	50	25	58
Expert 9	92	67	25	58	100	83	42	50	17	75	8	33
Expert 10	92	75	17	58	100	83	33	50	25	42	8	67
Weighted average expert assessment of significance	92,50	72,50	20,83	64,17	95,00	87,50	37,50	42,50	15,00	49,17	14,17	59,17

Table 1 shows that per the expert assessments, the most significant indicator used in the comparative analysis is “High frequency data updating”. The second most significant indicator is “Accurate data categorization”. The third most significant indicator is “Large volume of indexed data”. The remaining indicators are ranked in the following manner: “Ease of use of the application” occupies the fourth position, “Certain level of qualifications required from the people working with the application” occupies the fifth position. Next comes the “Specialized algorithms for particular groups of web sources (business analytics)” indicator, which is at the sixth position. The seventh position is occupied by the “Simple and complex search capability” indicator. “Results filtering capability according to date or period” is ranked eighth and this indicator is followed by “Output of similar results”. The least significant indicators in the ranking are “Data indexation capability in different languages”, “Navigation through the user interface” and “Priority output of popular results”.

3. Assessment of information systems for the indexation and analysis of online publications

The information systems that are assessed in this study have been selected on the basis of the following criteria:

- Popularity among users of similar software applications;
- Availability of at least three of the defined assessment indicators;
- Possibility for determining the existence or lack of the functionality represented by the respected defined indicator, which could lead to giving the most adequate assessments.

The assessments obtained after carrying out the comparative analysis are outlined in Table 2. These assessments are obtained by applying the average weighted approach by using the following formula:

$$\text{general assessment} = \sum_{i=1}^{11} (X_i \times p_i)$$

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Where:

general assessment – general assessment obtained as a result of the comparative analysis;

i – serial number of the indicator;

X_i – points assigned to the i -th indicator;

p_i – weighted coefficient of the i -th indicator.

Table 2.
Assessment based on the comparative analysis conducted

№	Information system	Assessment
1	Focus Monitoring	503,33
2	MediaSpy	210,83
3	Media Monitor	166,67
4	NewsRain	503,33
5	ORM.BG	172,50
6	HeadLine	177,50
7	New Media Lab	172,50
8	5W Communications	172,50
9	Neticle	341,67
10	MediaZoom	415,83
11	CrossDisplay	503,33
12	A Data Pro	221,67
13	Google	339,17
14	Yahoo	259,17
15	Bing	259,17
16	Cision	389,17
17	Mension	389,17
18	TrendKite	253,33
19	Datascouting	187,50
20	Brandwatch	236,67
21	Isentia	325,00
22	SDL Social Media Monitoring	301,67
23	GraphyStories	246,67
24	Meltwater	389,17

25	NUVI	295,83
26	MediaMiser	230,00
27	Universal Information Services	346,67
28	CyberAlert	309,17
29	BurrellesLuce	269,17
30	CustomScoop	316,67
31	Metro Monitor	309,17
32	Gorkana	399,17
33	Lone Buffalo	210,83
34	MediaVantage	236,67
35	Press Monitor	338,33
36	MediaConnect	265,83

According to the data from Table 2, the assessments of information systems for the indexation and analysis of online publications are within the range of 166,67 and 503,33 points, the maximum number of points that can be assigned being 650 points. Only three of the studied information systems have over 500 assessment points. The majority of the systems, namely 14, have between 300 and 400 assessment points. The information systems that have between 200 and 300 assessment points are 13 while 6 of the studied systems have been assigned under 200 points.

The performed comparative analysis and the assessment of the strengths and weaknesses of the researched information systems are the starting point for developing and offering a concept for a new information system.

4. Concept for an information system for the indexation and analysis of online publications

The availability of as much information as possible is of key importance for the process of making adequate management decisions. An important part of the information nowadays can be found on the Internet. With reference to this, the capability of retrieving and analysing online information has a direct impact on the process of making appropriate

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management decisions. In addition, under conditions of uncertain information environment it is possible to create a medium that can facilitate the prevention or elimination of these problems by using the modern information technologies. This takes into account the necessity of developing a concept for an information system for the indexation and analysis of data from the Internet in the context of making adequate management decisions. The concept of the system design is also based on the comparative analysis conducted in this study.

The development of a conceptual model of a business intelligence system requires and imposes the conceptual designing of all the components of such a system, including the data storage. To make possible the development of the conceptual model of a system for the indexation and analysis of Internet information, it is necessary to meet the prerequisites presented in Figure 1.

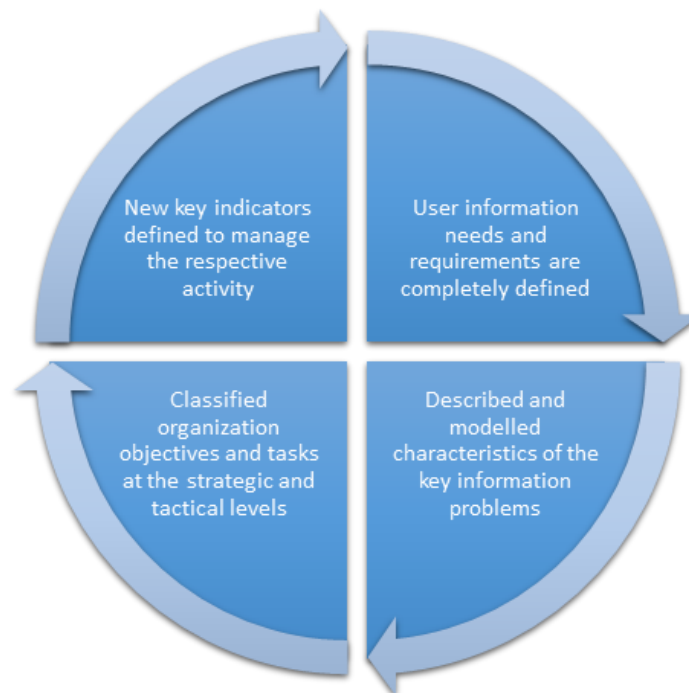


Figure 1. Prerequisites for developing the conceptual model

The process of developing conceptual models of information systems is a very complex and responsible task, which faces a number of challenges. The main positive aspects and benefits of this activity are as follows⁷:

- The conceptual model meets the effective organizational requirements;
- It can be a springboard for the easy realisation of the software system itself;
- It has capabilities for the dynamic addition of new objects, descriptions and facts;
- It allows and determines the presence of a sequence of steps in the development of the system, etc.

The concept of an information system for the indexation and analysis of Internet information involves the interconnectedness of two main technological aspects, namely an early warning software and a business intelligence analysis.

The implementation of early warning software solutions aims at reducing the risks for the organisations. These risks could be ecological, economic or related to the organisation's image to mention just a few. With reference to this, the developed concept includes several main functionalities, namely:

- Risk assessment;
- Data monitoring;
- Notification options through modern means of communication.

The risk assessment includes the systematic processing of as much information as possible referring to the particular risks. The monitoring involves methods for keeping under observation a system of indicators, which are important for the nature of the issues and can determine the risky situations right after they arise. Notification is a leading functionality through which information promptly reaches the individuals

⁷ A model for Business Intelligence Systems' Development, 12.07.2016, <http://revistaie.ase.ro/content/52/10%20-%20Bara,%20Botha.pdf>

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persons exposed to risks in a clear and understandable manner. With reference to this, the early warning software functionalities of the developed concept are a sequence of programming modules that implement assessment, monitoring and notification functionalities on the basis of the systematic processing of multiple data obtained from the preceding business intelligence analysis. The use of this analysis in the concept refers to the need of processing large amounts of data with various structures in order to overcome these differences and the subsequent storage and processing of the data in a uniform manner. The realisation of such a functionality involves using a sequence of three main methods, namely:

- Data retrieval;
- Data transformation;
- Data input and storage.

The sequence of actions within the framework of the concept of an information system for the indexation and analysis of Internet information in the context of the adequate management decision – making process is graphically illustrated in Figure 2.

The developed concept encompasses several main activities, namely:

- Determining the data sources;
- Performing a business intelligence analysis on these sources;
- Data retrieval;
- Temporary data storage in tables;
- Data transformation;
- Data input in the data storage;
- Application of early warning algorithms on the data storage based on pre – determined criteria;
- Use of the obtained results for adequate management decision – making.

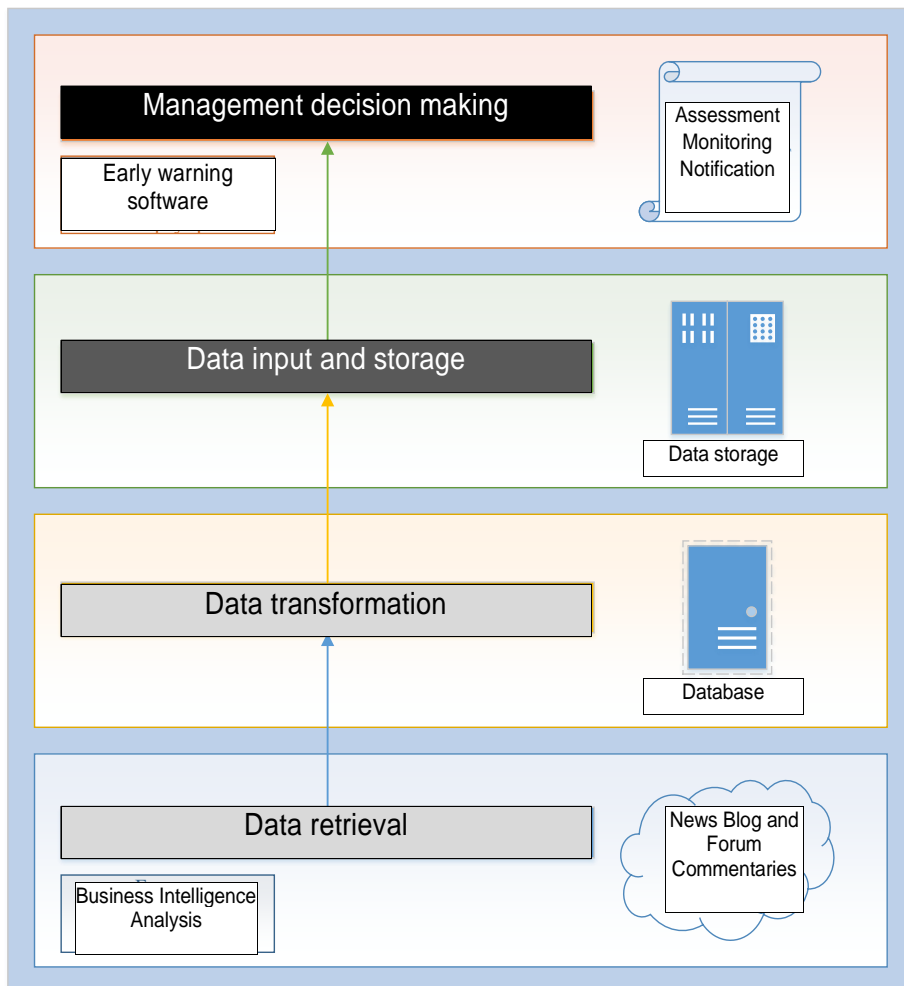


Figure 2. Sequence of actions in the concept of an information system for the indexation and analysis of Internet data

Conclusion

The main results from studying the present research problem refer to the following areas:

- The main theoretical principles of information systems for the indexation and analysis of online publications have been outlined;
- The indicators for assessing information systems for the indexation and analysis of online publications have been defined;
- A comparative analysis selected popular information systems for the indexation and analysis of online publications has been carried out;
- A concept for an information system for the indexation and analysis of online publications has been developed.

The main users of information systems for the indexation and analysis of online publications are marketing companies, public sector institutions, economic and political analysts, etc. In conclusion, the advantages of the concept offered for the indexation and analysis of online information can be defined as follows:

- Designing a solution, which provides information in real time, based on thorough analysis of the possible sources of informal data and their significance for making adequate management decisions;
- Developing a concept based on early warning and business intelligent data analysis;
- Developing a high technology achieved through applying a scientific analysis of the principles, techniques and methodologies used for developing the early warning software modules;
- Web – based architecture based on a special methodology for retrieving, transformation and storing data from online information sources;
- Continuous analysis of the conceptual compliance of the risk factors of the managerial decision – making process with the general software module;
- Good price / quality balance in providing the necessary reliability and stability of the supported technologies and implemented early warning and business intelligence technologies.

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The journal of "Business Management" publishes research articles, methodological articles and studies, review articles, book reviews, commentaries and good practices reports.

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- Articles: between 12 – 20 pages;
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- Format – Word for Windows 2003 (at least);
- Font – Times New Roman, size 14 pt, line spacing 1,5 lines;
- Page size – A4, 29–31 lines and 60–65 characters per line;
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- Title of article title; name, scientific degree and scientific title of author – font: Times New Roman, 14 pt, capital letters, Bold – centered;
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- Abstract – up to 30 lines; Key words – from three to five;
- **JEL** classification code for papers in Economics (<http://ideas.repec.org/j/index.html>);
- Introduction – it should be from half a page to a page long. It should state the main ideas and/or objectives of the study and justify the relevance of the discussed issue.
- The main body of the paper – it should contain discussion questions, an outline of the study and research findings/main conclusions; bibliographical citation and additional notes, explanations and comments written in the footnotes.
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- Graphs and figures – Word 2003 or Power Point; the tables, graphs and figures must be embedded in the text (to facilitate language correction and English translation); Font for numbers and inside text – Times New Roman, 12 pt;
- Formulae must be created with Equation Editor;

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When citing sources, authors should observe the requirements of **APA Style**. More information can be found at: <https://www.uni-svishtov.bg/default.asp?page=page&id=71#jan2017>, or: <http://owl.english.purdue.edu/owl/resource/560/01/>

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