

Preliminary Assessment of the Effectiveness of the Implementation of ERP Systems in Bulgarian SMEs

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JEL Classification: C83, L86

1. Introduction

Enterprise resource planning systems (ERP systems) refer to a class of software systems for businesses that are characterized by a high degree of complexity, the design of which is based on the best business practices. By presumption these systems are built on a modular basis with common database and have the major purpose to cover the whole factory, on the one hand to implement supply management, manufacturing, sales, finance and accounting, etc., and on the other hand to provide an integrated and direct access to information flows in real time (Petkov, 2004).

The development and implementation of software applications in an ERP

system is a difficult and responsible task. The success of the future work with the system depends largely on the successful selection of the modules for their implementation, as well as on the conduct of the due process. Internationally, the theory and practice of these systems do not provide a unified approach requiring a consistency in implementing the various possible components of the system and even less, a specific measure of the success of this process (ERP.BG),(Aarabi, 2012),(Lazarova, 2009). It is well known that the implementation procedure is highly dependent on the specifics of the ongoing business processes in enterprises. They in turn are determined by the economic environment of operation, the characteristics of the industry and the field, qualifications, skills and competencies of employees, macroeconomic conditions, and other factors. To this variety of conditions the strictly specific organization in the activities of a company should be added, as it may be an additional factor complicating implementation. Moreover, global practice

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as well as the Bulgarian one shows a number of unsuccessful attempts to implement ERP systems, followed by a serious loss of time, investment and customer interest (Abdel-Kader, 2011).

The listed circumstances as a whole determine the significant interest in the problem of measuring and evaluating the effectiveness of the implementation process, and the efficiency gains resulting from the implementation. This work presents the results of an empirical study aimed to characterize important aspects of the implementation process of ERP systems in the Bulgarian Small and Medium Enterprises (SMEs) and to define the need for a preliminary assessment of the effectiveness of this process. In the next section of the paper, we present the questionnaire developed to conduct a survey, and Section 3 describes the formation of a representative sample of small and medium-sized companies. The results of the empirical study are set out in Section 4, while Section 5 contains the conclusions and recommendations.

2. Questionnaire

The stage of preliminary preparation of the empirical study includes the following key elements:

- Development of a questionnaire with questions by which to determine the need for prior performance measurement of the implementation process;
- Development of guidelines for completing the questionnaire to avoid errors by respondents;
- Establishment of a cover letter.

The aim of the questionnaire is to collect data that are related to the activity of the enterprise in which the ERP system

will be implemented. The questionnaire includes questions related to the preliminary assessment of the effectiveness of system implementation. This is necessary in order to outline the general moments in the various enterprises in respect of the prior establishment of the effectiveness of ERP system implementation. In order to assess the usefulness of the process of preliminary measure of this efficiency, it is necessary to have information about the functioning of previously implemented ERP systems, if such are available. With the development of this questionnaire the following main goals are set:

- collect the necessary data to carry out research and evaluations;
- ensuring comparability in the data for individual companies;
- Reducing the possibility of bias.

The questionnaire is structured in a single section "Identifying the need to measure preliminary the effectiveness of the implementation process" and consists of following 14 questions.

1. Type of Enterprise?
 - Within the SME category according to LSME
 - Outside the SME category according to LSME
2. Are you client of Aloe Co Ltd.?
 - Yes
 - No
3. How long has it been since you implemented ERP system in your company
 - Less than one year;
 - Between one and three years;
 - More than three years.
4. How do you assess your satisfaction with the used ERP system?
 - It satisfies us completely
 - It rather satisfies us

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- It rather not satisfies us
 It does not satisfy us
5. Have it been conducted a preliminary assessment of the expected economic impact of ERP system at the stage of the its implementation (if the answer is "no" –go to question 9)
 - Yes
 - No
 6. The preliminary assessment of the economic impact was carried out with:
 - Quantitative Methods
 - Qualitative methods
 7. Preliminary assessment of the effect of the implementation is done by:
 - Team of the company implementer
 - Team of your own company
 8. The results of the preliminary assessment of the effectiveness are used by:
 - Management of the company - implementer;
 - The management of your company;
 - Both of them
 9. What functionality would you like to have your ERP system?

	Functionality	Yes	No
1	Manufacturing		
2	Supplies		
3	Clients		
4	Warehouse		
5	Marketing		
6	Accounting		
7	Finance		
8	Other, specify.....		

10. Do you perform assessment of the benefits and efficiency achieved for your company as a result of implementation of ERP system?
 - Yes
 - No
11. Do you think it is appropriate to use utility software for pre-establishing the

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- effectiveness of implementation of ERP system?
- Yes
 - No
12. If the results of the use of software to measure and evaluate the effectiveness show that your company is appropriate for ERP system implementation, would you introduce it?
 - Yes
 - No
 13. Do you think it is appropriate Aloe Co. Ltd. to develop an original methodology for assessing the effectiveness of ERP systems in SMEs?
 - Yes
 - No
 14. Would your company pay to use methodology and support software for preliminary measure of the effectiveness of ERP system implementation?
 - Yes
 - No

When designing questionnaires for surveys Zhelev (2002) states "three types of questions as to whether the criteria are formulated as any answers, or respondents are provided in free form to express their views and estimates", namely:

- ◆ Open questions
- ◆ Closed questions
- ◆ Semi-closed questions

On the basis of this division in the questionnaire for this study questions can be grouped into three groups:

1. Questions with possible answers Yes/No: seven questions suggest an answer only with 'yes' or 'no'
2. Questions with multiple choice answers from which one is selected: six questions offer a choice between two or more answers.

3. Questions with multiple choice answers, where you can choose more than one answer: one of the questions has additional sub-questions (details) and allows more than one possible answer.

When drawing up the questionnaire are avoided open questions (respondent puts own answer), as they create diversity in replies received and they become difficult for processing, significant problems arise in connection with the comparability of individual responses (Zhelev, 2002).

As a whole the developed questionnaire consists of three parts: cover letter, instructions for completion and the main part with the questions divided by sections. Instructions for completion are detailed and aim to facilitate maximum the respondents. Cover letter is describing the study, who is doing it and for what purposes, and how the data collected will be used.

3. Formation of a representative sample

With the designed questionnaire, empirical research was conducted on a sample of clients of Aloe Co. Ltd, a Bulgarian company, developer of business management systems with years of experience that develops its products in line with the latest trends in the sector and the specific needs of each client. The results of the survey are used to assess the need to measure the effectiveness of the process of implementation of ERP systems in SMEs.

When conducting the survey an important issue of determining is the size of the sample. According to (Mishev, 1998) small samples, consists of 30 units and large ones of more than 30 units. According to these authors, the sample size is calculated on the basis of predefined maximum error

and guarantee multiplier.

Other authors point out that the question of calculating the sample size has three general parts:

- Pragmatic expressed in the development and implementation of such criteria which would guarantee performance of the objectives of the study;
- Methodological expressed in calculating the standard deviation of the population and the application of a concrete statistical formula to a given sample model.
- Economic concerning the associated financial resources with the realization of the selected sample (Zhelev, 2002).

To determine the size of the sample we apply the following formula (Mishev, 1998):

$$n = \frac{z^2 \times \sigma_p^2 \times N}{\Delta_p^2 \times N \times z^2 \times \sigma_p^2}$$

Where:

n –size of the sample;

z –guarantee multiplier;

σ - standard deviation;

p –relative share of a given indicator;

Δ –maximum permissible error;

N –size of the population.

For the purposes of this study the following values are adopted for the above parameters:

z (guarantee multiplier) – 95% guaranteed probability, which is usually used in economic studies and its value is 1.96;

σ - standard deviation, which is obtained as , where p is the relative share of a given indicator. When $p = 0.5$ is obtained $\sigma^2 = 0.25$;

Δ (maximum permissible error i.e. within what limits will fluctuate a given result because a sample is used, rather than a detailed study);

N (size of the population): approximately 300 companies.

From where it is calculated:

$$\pi = \frac{z^2 \times \sigma_p^2 \times N}{\Delta_p^2 \times N + z^2 \times \sigma_p^2} = \frac{1,96^2 \times 0,25 \times 264}{0,11^2 \times 264 + 1,96^2 \times 0,25} \approx 55 \text{ companies}$$

In realizing the sample size of 55 plants, the maximum permissible error, which is about 0.11, will be eligible for this type of research. In this regard, according to (Saikova, 2002) as the estimates are derived from a representative sample survey the error of the assessment has three components:

- sNon-stochastic component of the error. It is caused by the action of factors (causes)

that can occur along the entire chain of planning, organizing and conducting the statistical study. Its specific sources can be various. An important feature of the component is that it is not probabilistic in nature and cannot be estimated in a probabilistic way. In the statistical literature there is no single methodology for its evaluation. Most often it is based on experimental studies, control censuses or expertise;

Table 1. Companies

1	Mars Armor Ltd.	23	Vilmat Holding AD	45	Soft Communications Ltd.
2	Alex-Alexander Hristov Spasov SP.	24	Karana Ltd.	46	Bella Bulgaria AD
3	Class Ltd.	25	Incosmetics AD	47	Expo 2000 Real Estate Ltd.
4	Destination Bulgaria Ltd.	26	STS Print AD.	48	FS Holding AD
5	LUBRIFILT Ltd.	27	Trakia Market Ltd.	49	Brandex Bulgaria Ltd.
6	Sys Group Co. Ltd.	28	Orchid Management - Bulgaria Ltd.	50	TZUM AD
7	Lunatone-BG Ltd.	29	CallPoint New Europe Plc.	51	Bulgarian American Property Management Ltd.
8	S & DI PHARMA LOGISTICS BG Ltd.	30	Venig Commerce Ltd.	52	Euromarket DRB Ltd
9	Agiva Ltd.	31	Balkan Project Management AD	53	Alta Bulgaria Ltd.
10	GUNIFAL Ltd.	32	KZU Plc.	54	Trust Capital Ltd.
11	In Bags Ltd.	33	European Kanvardzhans Property Company Bulgaria Ltd.	55	Persy Ltd.
12	Stoychevi 57-62 Ltd.	34	AG Packaging Ltd.	56	S & D Chemicals BG Ltd.
13	Hospital Medical Center Ltd	35	Heli R Sau AD	57	ING Pension Insurance Company Ltd.
14	BALANCE H - Nikolay Stanev ET	36	Tanand Ltd.	58	Herlitz Bulgaria Ltd.
15	Triad Transport and Logistics Ltd	37	Aldy Ltd.	59	Maran 2000 Ltd.
16	Bio Fresh Ltd.	38	Biliana-Triko AD	60	Zyoke Bulgaria Ltd.
17	Artec Developing Ltd.	39	STS Holding Group Ltd.	61	Industrial Holding Trust AD
18	Hauraton Bulgaria Ltd.	40	MVM Ltd.	62	Trust United Holding AD.
19	BM KANSALT Ltd.	41	Alpine Meyreder Bau GmbH - branch Bulgaria Ltd.	63	Riton-P AD
20	Veka Consult Ltd	42	Austrotherm Bulgaria Ltd.	64	Toni Bad Ltd.
21	VIA KO AD	43	UVI United Vision Ltd.	65	Maritsatex AD
22	Inkofoods Ltd.	44	AC Supreme Ltd.		

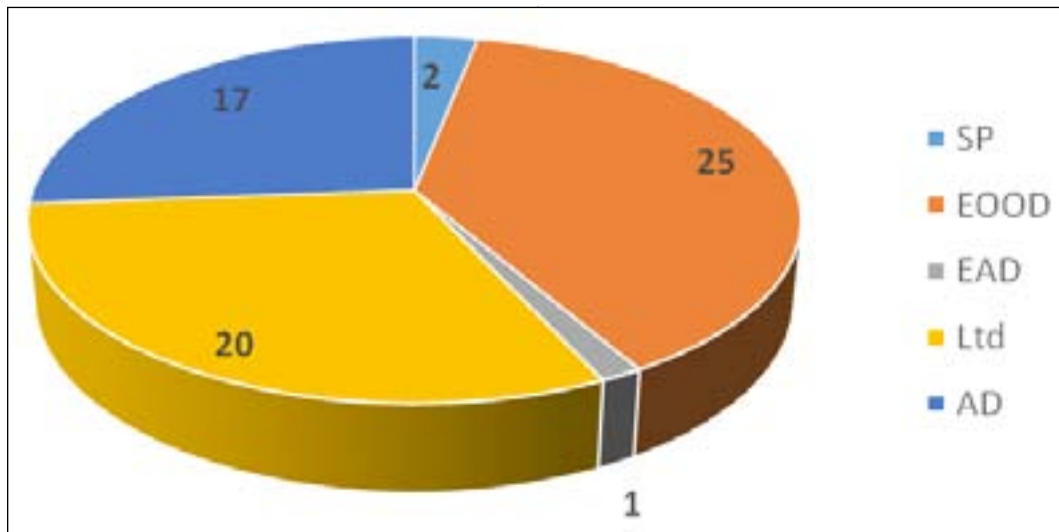


Fig. 1. Distribution of the population by type of enterprises in units

- Random component of the error. It is assumed to reflect purely accidental impacts on the assessment and with sufficiently large number of cases studied, these effects are expected to compensate each other;
- Stochastic component of sampling error. It has a place in the transition from the evaluation of the sample to the characteristic of the population.

The model and the sample size are determined during the preliminary phase of the study. The sample was drawn in a way to ensure that the findings and conclusions that are made on its base, apply to the population of firms. For the purposes of this study is used a stratified (grouped) sample.

Reasons for stratification of the population are mainly two:

1. Increasing the statistical efficiency;
2. Adequate data for analyzing the different subsets separately. (Zhelev, 2002)

Table 1 presents the population of companies which includes the empirical study.

Figures 1 and 2 graphically depict the distribution of the population by type of

enterprises, respectively, in absolute terms and as a percentage.

Figures 3 and 4 graphically depict the distribution of enterprises in the population by year of implementation of ERP system, respectively, in units and percentages.

Based on this data, 55 companies were randomly selected from the general population among which was conducted the empirical study.

4. Conducting the survey and results of the empirical study

On conducting the study we accepted the approach of questioning the companies on-site or through sending questionnaires via the email.

The inquiry of businesses by visiting gives the opportunity to study the peculiarities of the functioning of the administration of the visited companies, carries higher reliability of the collected data and faster collection of the questionnaires. On the other hand it has its disadvantages such as high costs, including business trips, transport and

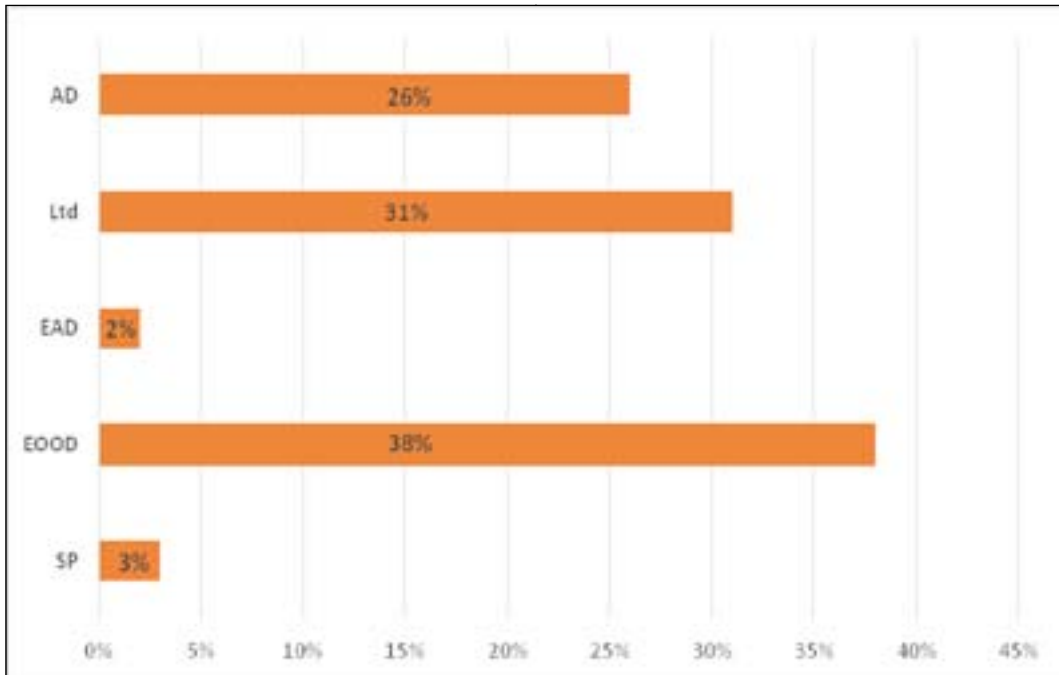


Fig. 2. Distribution of the population by type of enterprises in percentages

others, more difficult coordination of the dates for the survey due to involvement of the relevant officials.

The survey of businesses by sending a

questionnaire via the mail has advantages, such as lower costs and the possible encompassing of a significant number of companies included in the sample. The

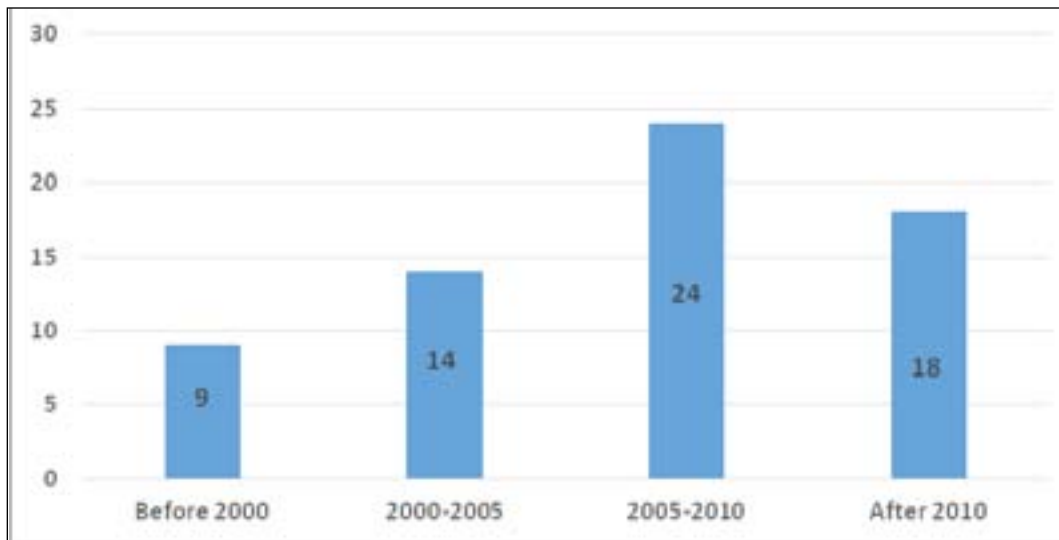


Fig. 3. Distribution of firms by year of implementation of ERP system (in units)

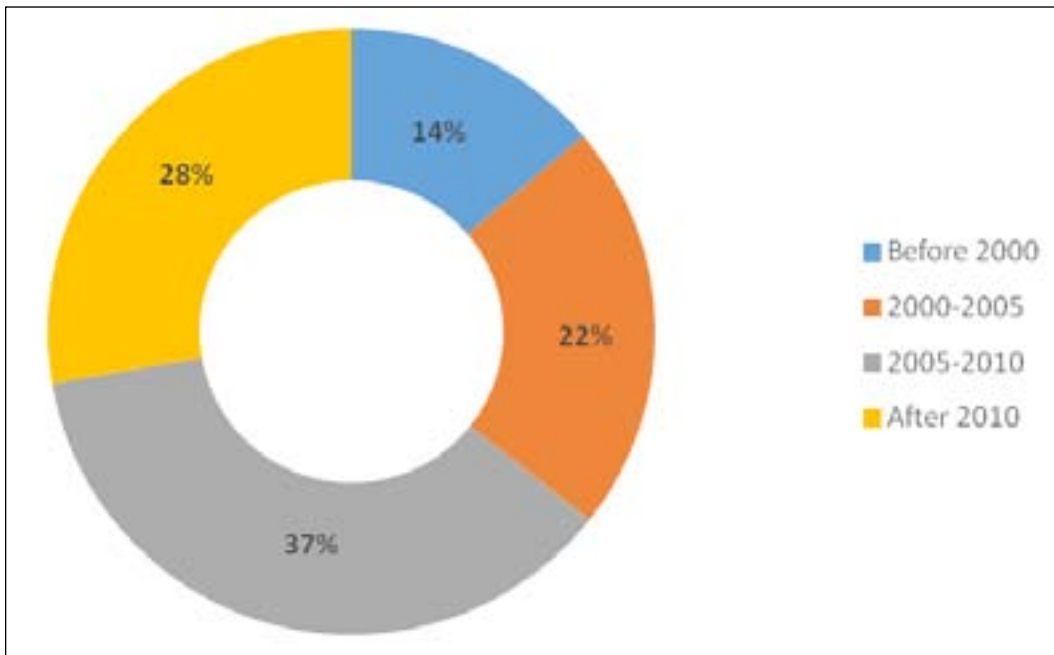


Fig. 1. Distribution of the population by type of enterprises in units

disadvantages are less reliability of the data collected, the slower collection of questionnaires, a need to conduct a few phone calls in order to coordinate the process of filling in the questionnaire.

Given these advantages and disadvantages and the striving for maximum reliability of the data collected by companies in the sample, we applied a diversified approach for data collection as presented in figure 5.

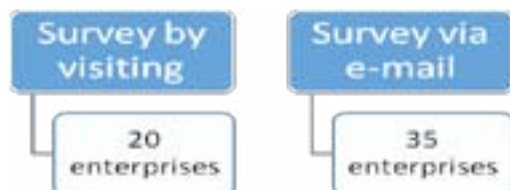


Figure 5. Enterprises by survey mode

After the survey was conducted, a process of editing questionnaires was carried out to remove errors, such as from

improperly completed questionnaires, inconsistent answers and other omissions.

It is worth noting that no such difficulties were encountered in this study. This is largely due to the high percentage of completed questionnaires on-site. This process ensures to a significant extent that the responses correspond to the actual state of the processes in the enterprise, and that the cards are correctly completed by the relevant officials and there are no inconsistent answers.

An encryption is done according to the specifics of the questions and their answers. The majority of the answers in the questionnaire are of type Yes/No, which are coded as follows: "To answer 'Yes' assign the numerical value of 1, and 'No' the numerical value of 0." The remaining responses were coded depending on the specifics of the questions. Data from the

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questionnaires were entered into specially made format (file) of the software SPSS. Given that the sample consists of a few dozen cards, after their introduction again the paper copies are compared with the data entered.

Each question of the questionnaire is coded with symbol X followed by the number of the respective question, and the possible answers are encrypted as shown:

Question 1 (X1) Type of Enterprise - response *Within the SME category according to LSME* encrypted with 1, response "Outside the SME category according to LSME" encrypted with 2

Question 2 (X2) Are you client of Aloe Co Ltd.?, answer 'Yes' encrypted with 1, and 'No' encrypted with 0

Question 3 (X3) How long has it been since you implemented ERP system in your company – answer *less than one year* encrypted with 1, answer *between one and three years* encrypted with 2, answer *more than three years* encrypted with 3

Question 4 (X4) How do you assess your satisfaction with the used ERP system? response *It satisfies us completely* encrypted with 1, reply *It rather satisfies us* - with 2, response *It rather not satisfies us* - with 3, and response *It does not satisfy us* encrypted with 4

Question 5 (X5) Has a preliminary assessment been conducted of the expected economic impact of ERP system at the stage of the its implementation (if the answer is 'No', go to question 9); answer 'Yes' encrypted with 1, answer 'No' encrypted with 0

Question 6 (X6) The preliminary assessment of the economic impact was carried out with: option *Quantitative*

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Methods encrypted with 1, option *Qualitative methods* encrypted with 2

Question 7(X7) Preliminary assessment of the effect of the implementation is done by: option *Team of the company implementers* encrypted with 1, option *Team of your own company* encrypted with 2

Question 8 (X8) the results of the preliminary assessment of the effectiveness are used by: answer *Management of the company – implementer* encrypted with 1, answer *The management of your company* encrypted with 2, answer *Both of them* encrypted with 3

Question 9 (X9) what functionality would you like to have your ERP system?, each answer 'Yes' is encrypted with 1, each answer 'No' with 0

Question 10 (X10) Do you perform assessment of the benefits and efficiency achieved for your company as a result of implementation of ERP system? response 'Yes' is encoded with 1, and answer 'No' with 0

Question 11(X11) Do you think it is appropriate to use utility software for pre-establishing the effectiveness of implementation of ERP system?, response 'Yes' is encoded with 1, and answer 'No' with 0

Question 12 (X12) If the results of the use of software to measure and evaluate the effectiveness show that your company is appropriate for ERP system implementation, would you introduce it?, response 'Yes' is encoded with 1, and answer 'No' with 0

Question 13 (X13). Do you think it is appropriate Aloe Co., Ltd. to develop an original methodology for assessing the effectiveness of ERP systems in SMEs?

response 'Yes' is encoded with 1, and answer 'No' with 0

Question 14 (X14). Would your company pay to use methodology and support software for preliminary measure of the effectiveness of ERP system implementation?, response 'Yes' is encoded with 1, and answer 'No' with 0

In accordance with that encryption the results of the survey are shown in Tables 2, 3 and 4 which are presented separately in Appendix 1. In summary, the analysis of these results allows us to draw the following conclusions.

From the answers of question № 3 it becomes evident that more than a half of the respondents have implemented ERP system for the period between 1 and 3 years, indicating that the companies feel the need to use this type of system, while at the same time introducing these systems in their practical activity is relatively new phenomenon.

Answers to question № 4 in turn indicate that only a small portion of the respondents, about 10%, were not satisfied with the use of an ERP system. The replies to question № 5 reveal that the majority of companies (60%) did not perform a preliminary assessment of the economic impact, which could be a possible factor for dissatisfaction with the subsequent implementation of an ERP system.

Questions № 6, 7 and 8 aim to identify the type of methods that have been used to draw a preliminary assessment of the economic efficiency of the survey which is based on these results. The answers show that the enterprises in which a preliminary assessment was carried out had applied mainly quantitative methods (59.09%) in the majority of cases (over 59.09%), assessment is performed by the company

implementer and results of this assessment are used primarily by management of the company implementer (77.27%). What is worth noting is the low percentage of the companies (22.73%) in which a preliminary assessment of the economic efficiency was done and whose management had not used its findings to improve their business.

Question № 9 of the questionnaire outlines the requirements of enterprises surveyed in terms of the preferred functionality of the ERP system. This question allows the respondents to specify more than one answer from the included eight modules - manufacturing, supplies, clients, warehouse, marketing, accounting, finance, and more. Four modules are specified by more than 50% of the respondents, namely: Clients (50.91%), Warehouse (52.73%), Marketing (56.36%) and Finance (52.73%). The other four modules - Manufacturing (45.45%) Supply (43.64%), accounting (49.09%), other modules (45.45%) were identified by 40% of respondents. These results show the high functionality of the modules necessary in the ERP system.

The answers to question № 10 show that most respondent enterprises (56.36%) did not assess the benefits and efficiency achieved from the implementation of an ERP system. By contrast, however, the answers to question № 11 clearly highlight the need for utility software that allows for the ensuring of an effective implementation of ERP system. Such necessity have declared 72.73 percent of the respondents, and this fact clearly supports the development of innovative products for the preliminary assessment of the effectiveness of the implementation process.

Questions 12, 13 and 14 aim to establish whether a effectiveness tested

in advance would prompt enterprises to implement an ERP system, and whether enterprises would trust Aloe Co Ltd to develop its own methodology for the assessment of the effectiveness of such system in SME and respectively whether enterprises would pay for using it. More than 50 % of the answers to these questions are positive, respectively 76, and 36% to question 1, 80% to question 2, and 54, 55 % to question 3. Particularly impressive is the high percentage of positive answers to question two, showing the high degree of trust of the respondent enterprises to Aloe Co Ltd, concerning the development of original methodology for assessment of the effectiveness of ERP systems in SMEs. As a whole the answers of the three questions are in support of the development of such a methodology and its realization in innovative software.

5. Conclusion

This work presents the results of an empirical study conducted in a sample of fifty-five Bulgarian enterprises and companies of small and medium scale. It is designed to study the implementation process of ERP systems in Bulgarian SMEs and to determine the need of preliminary assessment of the efficiency of this process. The analysis of these results shows that most of the respondents businesses use this type of systems, but have not carried out a preliminary assessment of the economic impact that could be one of the factors for dissatisfaction with the use of an ERP system. As a whole, the empirical results show that if there is a preliminary proven efficiency of the ERP system, companies are more likely to implement

it, which clearly indicates the need for development of a practical methodology and its software implementation enabling a preliminary assessment of the implementation process.

References

- Zhelev, S., 2002. Marketingovo izsledvane, Sofia, Trakia-M
- Lazarova, V., Oktomvri 2009. Ispolzvaemost na informatsionnite sistemi v Internet-dva tipa testove za potrebitelski interfeis. Mezhdunarodna nauchna konferentsia Informacionni tehnologii v upravlениeto na biznesa, Varna
- Mishev G., Tsvetkov S., 1998. Statistika za ikonomisti, Sofia, UI Stopanstvo
- Saikova I. , Stoikova-Kanalieva A., Saikova S., 2002. Statistichesko izsledvane na zavisimosti, Sofia, UI Stopanstvo
- Petkov Al., 2004. Upravlenski informatsionni sistemi, Ruse, PRIMAKS Ltd, s.132
- ERP.BG, 2014, [online] Available at < <http://erp.bg/>>
- Aarabi, M., Saman, M.Z.M., Wong, K.Y., Azadnia A.H., Zakuan N., 2012. A comparative study on critical success factors (CSFs) of ERP systems implementation among SMEs and large firms in developing countries, *International Journal of Advancements in Computing Technology*, Volume 4, Issue 9, pp. 226-239.
- Abdel-Kader, M., Nguyen, T.P., 2011. An investigation of Enterprise Resource Planning implementation in a small firm: A study of problems encountered and successes achieved, *International Journal of Enterprise Information Systems*, Volume 7, Issue 1, pp. 18-40.

Appendices

Appendix 1

Table 2. Data from Study, Part 1

	X1	X2	X3	X4	X5	X6	X7	X8
1	1	1	1	1	0			
2	1	1	1	2	0			
3	1	1	2	1	0			
4	1	1	2	1	0			
5	1	1	1	2	1	1	1	1
6	1	1	2	1	1	1	2	1
7	1	1	1	2	0			
8	1	1	2	2	0			
9	1	1	2	1	0			
10	1	1	2	1	0			
11	1	1	1	1	0			
12	1	1	2	2	0			
13	1	1	2	1	0			
14	1	1	2	2	0			
15	1	1	3	2	0			
16	1	1	2	1	1	1	1	2
17	1	1	1	2	0			
18	1	1	2	2	0			
19	1	1	1	2	0			
20	1	1	3	1	0			
21	1	1	2	2	1	1	2	1
22	1	1	1	3	0			
23	1	1	3	2	0			
24	1	1	2	3	1	2	1	1
25	1	1	1	2	1	2	1	1
26	1	1	1	1	1	2	2	1
27	1	1	2	1	1	1	2	1
28	1	1	3	2	0			
29	1	1	2	2	0			
30	1	1	2	3	1	1	1	1
31	1	1	2	1	0			
32	1	1	1	2	1	1	1	1
33	1	1	2	2	0			
34	1	1	2	1	0			
35	1	1	2	1	1	1	2	2
36	1	1	1	1	0			
37	1	1	2	2	1	1	1	2
38	1	1	2	1	0			
39	1	1	2	2	0			
40	1	1	3	2	1	2	2	2
41	1	1	2	1	1	1	1	1
42	1	1	1	2	1	1	2	1

43	1	1	2	2	0			
44	1	1	1	2	1	1	1	1
45	1	1	3	1	1	2	1	1
46	1	1	2	2	1	2	2	1
47	1	1	1	3	0			
48	1	1	3	2	0			
49	1	1	2	3	0			
50	1	1	1	2	0			
51	1	1	1	1	0			
52	1	1	2	1	1	1	1	1
53	1	1	3	2	1	2	1	2
54	1	1	2	2	1	2	1	1
55	1	1	2	3	1	2	2	1

Table 3. Data from Study, Part 2

	X9.1	X9.2	X9.3	X9.4	X9.5	X9.6	X9.7	X9.8
1	1	0	1	1	0	1	0	0
2	1	1	0	1	1	1	0	1
3	1	0	1	0	1	0	1	0
4	0	0	1	1	0	0	1	0
5	0	1	0	1	1	0	0	0
6	1	0	0	0	1	0	1	0
7	0	0	1	0	0	0	1	1
8	1	1	1	0	1	1	1	1
9	1	0	0	0	1	0	1	1
10	0	0	0	1	0	0	1	0
11	1	1	1	1	0	1	1	0
12	0	1	0	1	1	1	1	1
13	0	0	1	1	1	0	0	1
14	0	1	1	1	0	0	1	0
15	1	1	1	0	0	1	1	1
16	1	0	1	1	0	0	0	1
17	0	1	1	1	1	1	0	0
18	0	1	1	0	1	1	0	0
19	1	0	0	1	1	0	0	0
20	0	1	0	0	1	0	1	0
21	1	0	0	0	1	0	0	1
22	1	0	1	0	1	1	1	0
23	0	0	1	0	0	1	0	0
24	0	0	0	0	0	1	0	1
25	0	0	1	0	0	1	1	0
26	0	1	0	1	0	0	1	0
27	0	1	1	1	1	1	1	0
28	0	0	0	0	1	1	1	0
29	1	0	0	1	0	0	0	1
30	1	1	0	0	1	0	1	1
31	1	0	0	0	0	1	0	0

32	0	1	1	1	0	0	1	0
33	1	0	0	0	1	1	0	1
34	1	0	0	1	0	1	0	1
35	1	1	0	1	1	0	0	0
36	0	0	0	0	1	1	1	0
37	0	1	0	1	1	1	0	1
38	1	0	0	0	1	0	1	1
39	1	1	1	1	1	0	0	1
40	0	1	1	0	1	0	0	0
41	1	0	1	1	0	0	1	1
42	1	0	1	1	1	0	1	0
43	0	0	1	0	0	1	0	1
44	0	0	1	1	1	1	0	0
45	0	1	0	0	0	0	1	1
46	1	1	1	1	1	0	0	1
47	1	0	1	1	0	1	0	1
48	1	1	1	0	1	0	0	1
49	0	1	0	1	0	1	0	0
50	0	0	0	1	1	1	1	1
51	0	1	0	0	0	1	1	0
52	0	1	0	0	0	1	1	0
53	0	0	1	1	0	0	1	1
54	0	0	0	0	1	1	1	0
55	0	0	1	1	1	0	0	0

Table 4. Data from study, Part 3

	X10	X11	X12	X13	X14
1	1	1	0	0	1
2	0	1	1	1	0
3	0	1	1	0	1
4	0	0	1	1	1
5	1	1	1	1	1
6	0	1	1	1	1
7	0	1	1	0	1
8	0	1	1	1	1
9	0	1	0	0	0
10	0	0	1	1	0
11	1	0	1	1	1
12	1	1	1	1	1
13	0	0	1	1	0
14	0	0	0	1	1
15	1	1	1	1	0
16	1	1	1	1	1
17	0	1	0	1	1
18	1	0	1	0	1
19	1	0	1	1	1
20	0	1	1	1	0
21	0	1	1	1	0

22	1	1	1	1	0
23	1	1	1	0	1
24	0	1	1	1	0
25	0	1	0	0	0
26	1	1	1	1	1
27	1	1	1	1	0
28	1	1	1	1	1
29	0	1	1	1	1
30	0	1	0	1	1
31	1	1	1	1	1
32	1	1	1	1	1
33	0	0	1	1	0
34	1	1	1	1	0
35	0	1	0	0	0
36	1	1	1	1	0
37	0	0	1	1	1
38	0	0	1	1	0
39	0	1	0	1	1
40	1	1	1	0	0
41	1	1	1	1	1
42	0	1	1	0	0
43	0	0	0	1	1
44	1	1	1	1	1
45	0	1	0	1	1
46	0	1	1	1	1
47	1	0	0	1	0
48	0	0	1	1	0
49	0	0	1	1	0
50	0	0	0	1	1
51	0	1	1	1	0
52	1	1	1	1	1
53	1	1	0	0	0
54	0	1	1	1	0
55	1	1	1	1	0