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Information Systems in the Practice of Enterprises Activity

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Abstract. The article discusses the ability of enterprises to adopt and use information systems (IS). The classical adoption theories are tending to neglect market and industry characteristics as important factors in the adoption decision. In literature different factors (comparing and contrasting factors) that influence the adoption of IS are suggested for benchmarking. These factors alone, or in combination, may influence the adoption effects for various technologies differently. Talking about complex and continual adoption, ideas from complexity theory are important. In the paper the set of factors are used to explore complex organizations and industry adoption patterns. The analysis of literature shows that adoption of information systems should be understood and analyzed from the perspectives. Therefore, it is important to reveal the ability of enterprises to adopt information systems in the current challenging conditions, to evaluate, if enterprises, taking into account the new circumstances, are able to respond and adapt to these challenges adequately. So, the paper presents the results of investigations in this context. The aim of the research is to propose framework that incorporates factors determining the ability of enterprises to adopt information systems. The study presented in the paper contains three different aspects. First, the adoption of information systems is disclosed from different perspectives. Second, a theoretical framework that incorporates factors determining the ability of companies to adopt information systems is presented. Third, the application of framework for manufacturing and trade enterprises, located in 32 world countries, is given. The article is based on comparative and multiple criteria analysis. For the suggested framework, the set of criteria and the multiple criteria evaluation method (COPRAS) is used.

Keywords: Manufacturing, Trade, Enterprises, Comparison, Information systems, COPRAS.

1. Introduction

The analysis of literature shows that it is important to reveal the ability of enterprises to adopt information systems in the current challenging conditions, to evaluate, if enterprises, taking into account the new circumstances, are able to respond and adapt to these challenges adequately. The classical adoption theories are tending to neglect market and industry characteristics as important factors in the adoption decision. In literature different factors (comparing and contrasting factors) that influence the adoption of IS are suggested for benchmarking. These factors alone, or in combination, may influence the adoption effects for various technologies differently. Talking about complex and continual adoption, ideas from complexity theory are important. The set of factors are used in paper to explore complex organizations and industry adoption patterns.

The analysis of scientific literature published by Oxford University Press, Cambridge University Press, Harvard University Press, Springer, M. E. Sharpe, Routledge, etc. show that 5.39 million authors are talking about information systems. 4.0 thousand authors mention the role of trade and manufacturing enterprises. Most of these authors analyze the role of manufacturing enterprises (it is mentioned by 2.3 thousand authors), less of them analyze the role of trade enterprises (it is mentioned by 911 authors).

In addition, it is important to mention that such topic is not very popular among authors who dedicated books to information systems. Most of them are analyzing individual technology adoption, individual organizations' adoption decisions.

The research is aiming to propose framework, which incorporates factors determining the complex ability of enterprises to adopt information systems. To eliminate environmental factors two industries, located at the same country, are compared.

The research tasks are defined as follow: (1) the adoption of information systems is disclosed from different perspectives, (2) to present theoretical framework that incorporates factors determining the ability of enterprises to adopt information systems, and (3) to apply suggested framework for the comparison of manufacturing and trade enterprises located in 32 world countries.

Research objective is the framework that incorporates factors determining the ability of enterprises to adopt information systems.

The article is based on comparative and multiple criteria analysis. The scientific novelty of the study – presented the formulated framework, which incorporates factors determining the ability of enterprises to adopt information systems.

The proposed approach can be useful for authors, which analyze the issues related to information systems adoption.

2. The adoption of information systems

Information systems (IS) adoption is a process during which a problem is solved through the assessment and evaluation of alternative solutions. Namely organizations that develop IS, organizations that pioneer its use and advocate for its adoption by their trade partners, and the larger majority that ultimately adopt IS as a result. IS adoption models recognize both organizational and extra-organizational factors (Del Aguila-Obra and Padilla-Melendez, 2006). A brief review of both the conceptual and empirical literature provided below discusses some of the most important factors that affect IS adoption decisions.

In this section IS adoption models are quickly reviewed. First, Rogers' innovation adoption model (1995), where capable of adopting organization to apply the technology is a secondary consideration in the model. Rogers suggests that novelties adoption can be the result of the effects of five groups of determinants. The first group focuses on the perceived attributes of novelty. These include relative advantage (how much better the technology is comparing to it supersedes), compatibility (how well it meets needs), and simplicity (how easy the technology is). Second, it is MOA model, where the extent of innovation adoption is primarily determined by individual organization rather than the technology. Borrowing from individual level adoption models, theorists have attempted to describe technology adoption by placing their emphasis on organizational factors (Azadegan and Teich, 2010). The underlying factors for these models can be categorized into such groups: the organization's motivational factors; the organization's ability factors; and other external factors.

A criticism of classical adoption theories is that they tend to neglect market and industry characteristics as important factors in the adoption decision. An exception is that of the TOE. Finally, TOE model distinguishes how the industry, competitors, government and other near and far institutions can influence the adoption decision (Azadegan and Teich, 2010).

In literature authors Thatcher et al. (2006) are describing the degree to which various organizational, industrial, governmental and cultural factors influence IS adoption decisions. Governmental factors include government regulations and industrial factors - industry cycles. Cultural factors are a main driver of adoption decisions but it is clear that cultural factors can help us better understand how the confluence of organizational, industry and governmental factors do indeed influence decision making. In the individualistic culture of the United States, a "technology champion" often drives the adoption of IS. This is very different from Chinese cultures where IS adoption is more of a collective effort driven by a confluence of government, industry, and management initiatives.

In other words, the role of culture in IS adoption decisions inside countries may find no effects of culture until one differentiates between different industries.

Thatcher et al (2006) find out that the adoption of B2B systems by large customers has driven the adoption of these by their suppliers. In the United States, the electronics industry has also been more advanced than the textile industry in terms of linking enterprise resource planning (ERP) systems between organizations.

Successful technology adoption depends on multi-dimensional perspective, including those related to the adopter, to the technology, to the provider and the network within which they operate. Without careful consideration of these factors, effectiveness of benchmarking of individual technology adoptions may be remiss of predictable outcomes (Azadegan and Teich, 2010). How organizations assess the benefits (and risks) associated with technology adoptions is dependent on the type of technology and its lifecycle. Organization's readiness which includes its resistance to innovation, technology sophistication and the availability of finances in adopting new technologies should be less influential. The theoretical arguments made by systems theorists with those suggested from adoption theories to note three key factors to affect technology adoption: network size; network inter-connection; and technological infrastructure. For example, network factors are technological infrastructure and the level of collaboration between network members.

As a result, comparing and contrasting factors that influence the adoption of different IS may enhance the understanding of relationships and therefore allow for more effective benchmarking. Furthermore, organisations may follow industry expectations to adopt a technology. These factors alone, or in combination, may influence the adoption effects for various technologies differently. Talking about complex and continual adoption, ideas from complexity theory are important. The set of factors are used to explore complex organizations and industry behavior (Pathak et al., 2007 and Wycisk et al., 2008). So, bellow is provided theoretical framework that incorporates industry and continual organizational adoption patterns.

3. A theoretical framework that incorporates factors determining the ability of companies to adopt information systems

There are two groups of factors that are presented in the scientific literature: general factors, which are characterizing the continual adoption; and specific factors, which characterizing ability of enterprise to meet high risk.

For the framework, that incorporates factors determining the ability of enterprises to adopt information systems, the set of nine criteria is used. So, this set consists of such criteria, which characterize enterprises:

- Enterprises using open source operating systems;
- Enterprises using LAN and Intranet or extranet in reference year;
- Enterprises sending and/or receiving e-invoices;
- Enterprises who have ERP software package to share data on

sales/purchases;

- Enterprises, which linked business processes automatically to their suppliers and/or customers;
- Enterprises using automated data exchange for sending or receiving data to / from public authorities;
- Enterprises using automated data exchange for sending payment instructions to financial institutions;
- Enterprises, which are not using advanced e-signatures in relations with suppliers / clients;
- Enterprises, which are not offering secure transactions when receiving orders over Internet.

The author underlines that the aforementioned set of criteria can describe the ability of enterprises to adopt various information systems from different perspectives. For the comparison of manufacturing and trade enterprises multiple criteria method COPRAS is used. In quantitative comparison each alternative is described by nine criteria. Some of these criteria have different direction (Turskis et al., 2009). Maximising and minimising criteria are with different directions. Bellow (Table 1), the criteria and their direction – maximizing or minimizing (i.e. max or min in column 3), is defined.

For long time managers are dealing with multiple criteria issues (Zavadskas and Turskis, 2011; Antucheviciene et al., 2010). Numerous methods have been developed for the analysis of such problems (Peldschus, 2009). One multiple criteria method is the method of Complex Proportional Assessment of alternatives (COPRAS). During the application of method direct and proportional dependences are assumed and the alternatives, values and weights of criteria are adequately described (Turskis et al., 2009). Among Lithuania scientists COPRAS method is used widely (for example, by Kildiene et al., 2011; Ginevicius and Podvezko, 2009; Ginevicius and Podvezko, 2008; Andruskevicius, 2005; Malinauskas and Kalibatas, 2005). Based on such type of methods, the multiple criteria problem is represented by a matrix. In our case the matrix contains of 32 alternatives (rows) and 9 criteria (columns). In order to avoid the difficulties caused by different dimensions of nine criteria, normalization is used (Ginevicius, 2008). The transformed values of nine criteria of thirty-two countries are given in Table 2 and Table 3. The criteria weights (Table 1) are determined by the experienced experts from ICT companies and home University. The number of experts is limited to ten. Calculations are more accurate and more objective when number of experts is higher.

The application of multiple criteria methods depends on the calculation of criteria weights. Usually experts are used for the estimation of weights. In our case study 10 experts were used (Table 1).

The consistency of experts' judgments is checked using the coefficient of concordance. The sum of scores, presented by experts:

$$c = \sum_{j=1}^{r} c_{ij} (i = 1,...,m) = 450,$$

here m is the number of alternatives; r – the number of experts.

The coefficient of concordance W is calculated according such formula:

$$W = \frac{S}{S_{\max}}, when \;\; S = \sum_{i=1}^{m} (c_i - \bar{c})^2,$$

here S is the sum of deviations, which shows difference from average squared, S_{max} – the sum of deviations in ideally agreed case, $\bar{c}$ – overall average is calculated:

$$\bar{c} = \frac{1}{2} r(m+1) = \frac{1}{2} \cdot 10 \cdot (9+1) = 50, \text{ when } S = 2732.$$

Table 1. The estimation of weights by experts

No	Criterion	The direction of criterion	Experts										The sum of scores	Deviations from the average	The significance of criterion	The average
			1	2	3	4	5	6	7	8	9	10				
1	Enterprises using open source operating systems, %	Max	1.5	1	1.5	1	2.5	1	1.5	7.5	7.5	6	31	361	0.172	8.948
2	Enterprises using LAN and Intranet or extranet in reference year, %	Max	4	2	6	2	1	2.5	3.5	4	3	3	31	361	0.157	8.181
3	Enterprises sending and/or receiving e-invoices, %	Max	1.5	3	1.5	3	2.5	2.5	1.5	2.5	2	2	22	784	0.157	8.162
4	Enterprises who have ERP software package to share information on sales/purchases with other internal functional areas, %	Max	8.5	9	8.5	6.5	8	8.0	8	2.5	1	4	64	196	0.067	3.469
5	Enterprises whose business processes are automatically linked to those of their suppliers and/or customers, %	Max	5.0	8	5.5	5	7	4.5	5.5	5.5	4	9	59	81	0.076	3.945
6	Enterprises using automated data exchange for sending or receiving data to / from public authorities, %	Max	4	4.5	4	6.5	5.5	5.0	5.5	9	6	5	55	25	0.102	5.328
7	Enterprises using automated data exchange for sending payment instructions to financial institutions, %	Max	8.0	6.5	5.5	6.5	5.5	8.5	8	5.5	9	8	71	441	0.085	4.399
8	Enterprises, which are not using advanced e-signatures in relations with suppliers / clients, %	Min	8.5	6.5	7	8	9	8.5	8	7.5	7.5	1	72	462	0.073	3.797
9	Enterprises, which are not offering secure transactions when receiving orders over Internet, %	Min	4	4.5	5.5	6.5	4	4.5	3.5	1	5	7	46	20	0.111	5.771
Suma			45	45	45	45	45	45	45	45	45	45	450	2732	1.000	52.000
Average													50.0			

The sum of deviations in ideally agreed case:

$$S_{\max} = \frac{r^2 m(m^2-1)}{12} = \frac{100 \cdot 9 \cdot (81-1)}{12} = 6000, \text{ after } W = \frac{S}{S_{\max}} = \frac{2732}{6000} = 0.46.$$

The significance x^2 for the coefficient of concordance is calculated as follows:

$$x^2 = Wr(m-1) = 0.46 \cdot 10 \cdot (9-1) = 36.42.$$

Random number x^2 is distributed under x^2 with ν=m−1 the degrees of freedom of the chosen significance level α (in practice α is usually equal to the value of 0.05 or 0.01).

The assessments of experts are aligned calculated x^2 value is greater than the x_{kr} (which is taken from tables of distribution with ν=9−1=8 the degrees of freedom

and significance level α=0,05and is equal to 14.79). The coefficient of concordance is equal to 0.46 (its significance is equal to 36.42 and is greater than the critical value – equal to 14.79) and shows that experts' judgments are in a good agreement. This means that the weights of criteria (estimated by experts) can be used for analysis (Podvezko, 2005).

Finally, the weights of criteria are placed into framework. The criterion, which represents the usage of open source operating system, received the highest experts' interest. After this the matrix is normalized. The sum of normalized values is equal as always to one (Turskis et al., 2009).

4. The comparisons of manufacturing and trade enterprises from different countries

This part of the paper is dedicated to the application of developed framework. For the comparisons of manufacturing and trade enterprises Eurostat (2010) data, which is collected using questionnaire, is taken.

The sample size is determined by statistical analysis. The results of the analysis of survey sample show that it is sufficient. In order to ensure 95% reliability of statistical data and 4% of allowable inaccuracy 1.22% manufacturing and 1.20% trade enterprises have to be questioned. During Eurostat survey 3.31% manufacturing and 2.92% trade enterprises have been interviewed.

The results of the comparisons show that Belgium manufacturing and Germany trade enterprises are the most active in adopting IS: these enterprises have received the highest score (Table 2 and Table 3).

It is noted that 45% of Belgium manufacturing enterprises are using LAN and Intranet or extranet in reference year; 41% of them are sending and/or receiving e-invoices; 34% of them – enterprises whose business processes are automatically linked to those of their suppliers and/or customers; 48% of them – using automated data exchange for sending or receiving data to/ from public authorities. The results of the comparison of manufacturing enterprises show that Belgium manufacturing enterprises have received the highest scores (Table 2).

In general, from all researched manufacturing enterprises 16.5% enterprises are using open source operating systems; 37.8 % of them – using LAN and Intranet or extranet in reference year, 32.8% of them are sending and/or receiving e-invoices, 20% of them – enterprises whose business processes are automatically linked to those of their suppliers and/or customers; 37.8% of them – using automated data exchange for sending or receiving data to/ from public authorities.

It is clarified that 31% of Germany trade enterprises using open source operating systems; 51 % of them – using LAN and Intranet or extranet in reference year; 31% of them – enterprises whose business processes are automatically linked to those of their suppliers and/or customers; 45% of them are sending and/or receiving e-invoices. The results of the comparison of trade enterprises show that Germany trade enterprises have received the highest scores (Table 3).

In general, from all researched trade enterprises 14.7% enterprises are using open source operating systems; 48.4 % of them – using LAN and Intranet or extranet in reference year; 24.4% of them – enterprises whose business processes are automatically linked to those of their suppliers and/or customers; 38.4% of them are sending and/or receiving e-invoices; 36.8% of them – using automated data exchange for sending or receiving data to/ from public authorities.

The results of research show that manufacturing enterprises are more active in adoption of information systems. Trade companies are more passive with applying security IS.

The comparison of manufacturing and trade enterprises shows that continual adoption have imbalances between enterprises, located in Netherlands, Austria, Finland, Portugal, Greece, Czech Republic and Iceland.

Especially differences are seen in Iceland, where manufacturing enterprises are behind trade enterprises by 13 places, and Czech Republic, where manufacturing enterprises are above trade enterprises by 10 places.

The results of the study show that the framework, which incorporates factors determining the ability of companies to adopt information systems, is important to authors, which analyze the ability of enterprises to adopt information systems.

5. Conclusions

The analysis of literature shows that it is important to reveal the ability of enterprises to adopt information systems in the current challenging conditions, to compare enterprises from different countries, to evaluate, if enterprises are able to respond and adapt to these challenges adequately taking into account the new circumstances.

Different factors, influencing the adoption of information systems, are suggested in literature. Most of them are used for analyzing individual technology adoption or individual organizations' adoption decisions. But topic oriented for complex and continual adoption is not very popular among authors dedicated books for to information systems. Talking about role of enterprises in adoption of information systems authors give more attention to manufacturing ones.

Table 2. The comparison of manufacturing enterprises

By country	Enterprises using open source operating systems, %	Enterprises using LAN and Internet or extranet in reference year, %	Enterprises sending and/or receiving e-invoices, %	Enterprises who have ERP software package to share information on sales/purchases with other internal functional areas,	Enterprises whose business processes are automatically linked to those of their suppliers and/or	Enterprises using automated data exchange for sending or receiving data to / from public	Enterprises using automated data exchange for sending payment instructions to financial institutions, %	Enterprises, which are not using advanced e-signatures in relations with suppliers / clients, %	Enterprises, which are not offering secure transactions when receiving orders over Internet, %
Significance of criteria	0.17	0.16	0.16	0.07	0.08	0.10	0.08	0.07	0.11
Belgium	14	45	41	37	34	48	56	60	93
Germany	22	43	33	37	29	38	54	79	92
Lithuania	16	31	50	6	35	52	39	31	93
Luxembourg	20	46	30	25	25	40	57	61	94
Italy	17	30	62	12	22	30	55	76	99
Sweden	13	48	33	48	28	37	39	65	89
Slovenia	17	36	10	30	17	60	53	3	90
Latvia	19	30	43	5	35	44	38	56	99
Finland	19	45	33	37	18	36	33	84	96
Slovakia	20	39	31	18	26	38	39	74	98
France	15	46	33	32	13	32	35	71	95
Netherlands	14	32	32	40	6	57	35	75	92
Poland	18	41	16	13	16	44	34	51	97
Austria	22	36	19	35	13	28	26	87	93
Ireland	13	43	29	29	16	28	27	81	88
Denmark	9	39	33	32	13	23	37	75	92
Czech Republic	24	32	18	19	14	16	26	56	94
Malta	8	41	32	23	19	30	34	87	93
Norway	7	33	37	21	17	41	30	88	91
Estonia	18	26	36	9	12	36	13	76	97
Portugal	10	26	24	16	42	35	27	92	97
Croatia	12	25	20	14	53	17	27	70	96
Spain	9	30	25	24	15	25	33	46	95
United Kingdom	8	29	14	14	7	74	45	85	92
Bulgaria	12	30	27	7	18	31	14	50	100
Iceland	16	37	19	24	6	21	18	84	96
Turkey	13	39	15	12	17	21	20	88	97
Hungary	19	19	6	9	9	41	33	86	98
Greece	10	30	10	36	14	11	25	91	99
Romania	11	23	18	12	13	19	16	92	99
Former Yugoslav F	7	18	8	13	13	8	15	81	99
Cyprus	6	11	4	12	4	3	4	98	100
Sum	458	1079	841	701	619	1064	1037	2299	3043
Sum multiplied from the significance	79	170	132	47	47	109	88	168	338
				Sum equal to 1246					

Matrix

By country	Enterprises using open source operating systems, %	Enterprises using LAN and Internet or extranet in reference year, %	Enterprises sending and/or receiving e-invoices, %	Enterprises who have ERP software package to share information on sales/purch	Enterprises whose business processes are automatically linked to those of their	Enterprises using automated data exchange for sending or receiving data to / from public	Enterprises using automated data exchange for sending payment instructions to financial	Enterprises, which are not using advanced e-signatures in relations with suppliers / clients, %	Enterprises, which are not offering secure transactions when receiving orders over Internet, %
Belgium	0.005	0.007	0.008	0.004	0.004	0.005	0.005	0.002	0.003
Germany	0.008	0.006	0.006	0.004	0.004	0.004	0.004	0.003	0.003
Lithuania	0.006	0.005	0.009	0.001	0.004	0.005	0.003	0.001	0.003
Luxembourg	0.008	0.007	0.006	0.002	0.003	0.004	0.005	0.002	0.003
Italy	0.006	0.004	0.012	0.001	0.003	0.003	0.004	0.002	0.004
Sweden	0.005	0.007	0.006	0.005	0.003	0.004	0.003	0.002	0.003
Slovenia	0.006	0.005	0.002	0.003	0.002	0.006	0.004	0.000	0.003
Latvia	0.007	0.004	0.008	0.000	0.004	0.004	0.003	0.002	0.004
Finland	0.007	0.007	0.006	0.004	0.002	0.003	0.003	0.003	0.004
Slovakia	0.008	0.006	0.006	0.002	0.003	0.004	0.003	0.002	0.004
France	0.006	0.007	0.006	0.003	0.002	0.003	0.003	0.002	0.003
Netherlands	0.005	0.005	0.006	0.004	0.001	0.005	0.003	0.002	0.003
Poland	0.007	0.006	0.003	0.001	0.002	0.004	0.003	0.002	0.004
Austria	0.008	0.005	0.004	0.003	0.002	0.003	0.002	0.003	0.003
Ireland	0.005	0.006	0.005	0.003	0.002	0.003	0.002	0.003	0.003
Denmark	0.003	0.006	0.006	0.003	0.002	0.002	0.003	0.002	0.003
Czech Republic	0.009	0.005	0.003	0.002	0.002	0.002	0.002	0.002	0.003
Malta	0.003	0.006	0.006	0.002	0.002	0.003	0.003	0.003	0.003
Norway	0.003	0.005	0.007	0.002	0.002	0.004	0.002	0.003	0.003
Estonia	0.007	0.004	0.007	0.001	0.001	0.003	0.001	0.002	0.004
Portugal	0.004	0.004	0.004	0.002	0.005	0.003	0.002	0.003	0.004
Croatia	0.005	0.004	0.004	0.001	0.006	0.002	0.002	0.002	0.004
Spain	0.003	0.004	0.005	0.002	0.002	0.002	0.003	0.001	0.003
United Kingdom	0.003	0.004	0.003	0.001	0.001	0.007	0.004	0.003	0.003
Bulgaria	0.005	0.004	0.005	0.001	0.002	0.003	0.001	0.002	0.004
Iceland	0.006	0.005	0.004	0.002	0.001	0.002	0.001	0.003	0.004
Turkey	0.005	0.006	0.003	0.001	0.002	0.002	0.002	0.003	0.004
Hungary	0.007	0.003	0.001	0.001	0.001	0.004	0.003	0.003	0.004
Greece	0.004	0.004	0.002	0.003	0.002	0.001	0.002	0.003	0.004
Romania	0.004	0.003	0.003	0.001	0.002	0.002	0.001	0.003	0.004
Former Yugoslav F	0.003	0.003	0.001	0.001	0.002	0.001	0.001	0.003	0.004
Cyprus	0.002	0.002	0.001	0.001	0.000	0.000	0.000	0.003	0.004
Sum	0.172	0.157	0.157	0.067	0.076	0.102	0.085	0.073	0.111

By country	The sum of the matrix values	Sum of maximizing values	Sum of minimizing values	Minimizing values by the country, which has the least minimizing value	The relative importance of comparative options	Priority row
Belgium	0.042	0.0364	0.0053	0.538	0.04248	1
Germany	0.042	0.0358	0.0059	0.576	0.04137	2
Lithuania	0.037	0.0329	0.0044	0.772	0.04034	3
Luxembourg	0.039	0.0338	0.0054	0.629	0.03982	4
Italy	0.040	0.0335	0.0060	0.561	0.03894	5
Sweden	0.038	0.0328	0.0053	0.636	0.03890	6
Slovenia	0.032	0.0285	0.0034	1.000	0.03816	7
Latvia	0.037	0.0316	0.0054	0.627	0.03767	8
Finland	0.038	0.0317	0.0062	0.547	0.03701	9
Slovakia	0.037	0.0307	0.0059	0.570	0.03621	10
France	0.035	0.0291	0.0057	0.591	0.03476	11
Netherlands	0.035	0.0288	0.0057	0.589	0.03445	12
Poland	0.031	0.0259	0.0052	0.655	0.03224	13
Austria	0.033	0.0268	0.0062	0.549	0.03208	14
Ireland	0.032	0.0262	0.0058	0.584	0.03180	15
Denmark	0.031	0.0251	0.0057	0.589	0.03076	16
Czech Republic	0.029	0.0242	0.0052	0.649	0.03047	17
Malta	0.031	0.0251	0.0062	0.549	0.03041	18
Norway	0.031	0.0248	0.0061	0.552	0.03014	19
Estonia	0.030	0.0241	0.0060	0.568	0.02959	20
Portugal	0.031	0.0243	0.0065	0.523	0.02930	21
Croatia	0.029	0.0236	0.0057	0.590	0.02923	22
Spain	0.027	0.0216	0.0049	0.686	0.02824	23
United Kingdom	0.029	0.0228	0.0061	0.558	0.02820	24
Bulgaria	0.026	0.0209	0.0052	0.645	0.02713	25
Iceland	0.028	0.0215	0.0062	0.547	0.02673	26
Turkey	0.027	0.0202	0.0063	0.533	0.02538	27
Hungary	0.026	0.0196	0.0063	0.536	0.02478	28
Greece	0.025	0.0182	0.0065	0.520	0.02324	29
Romania	0.023	0.0167	0.0065	0.517	0.02169	30
Former Yugoslav F	0.018	0.0116	0.0062	0.546	0.01683	31
Cyprus	0.014	0.0069	0.0068	0.500	0.01166	32
Sum	1.000	0.8160	0.1840	19.129	1.0000	

Table 3. The comparison of trade enterprises

										Matrix													
By country	Enterprises using open source operating systems, %	Enterprises using LAN and Intranet or extranet in reference year, %	Enterprises sending and/or receiving e-invoices, %	Enterprises who have ERP software package to share information on sales/purchases with other internal functional areas, %	Enterprises whose business processes are automatically linked to those of their suppliers and/or customers, %	Enterprises using automated data exchange for sending or receiving data to / from public authorities, %	Enterprises using automated data exchange for sending payment instructions to financial institutions, %	Enterprises, which are not using advanced e-signatures in relations with suppliers / clients, %	Enterprises, which are not offering secure transactions when receiving orders over Internet, %	Enterprises using open source operating systems, %	Enterprises using LAN and Intranet or extranet in reference year, %	Enterprises sending and/or receiving e-invoices, %	Enterprises who have ERP software package to share information on sales/purcha	Enterprises whose business processes are automatically linked to those of their	Enterprises using automated data exchange for sending or receiving data to / from public	Enterprises using automated data exchange for sending payment instructions to financial	Enterprises, which are not using advanced e-signatures in relations with suppliers / clients, %	Enterprises, which are not offering secure transactions when receiving orders over Internet, %	The sum of the matrix values	Sum of maximizing values	Sum of minimizing values	Minimizing value by the country, which has the least minimizing value	The relative importance of comparative options	Priority row
Significance of criteria	0.17	0.16	0.16	0.07	0.08	0.10	0.08	0.07	0.11															
Germany	31	51	45	32	31	39	58	82	88	0.011	0.006	0.006	0.003	0.003	0.003	0.004	0.003	0.003	0.043	0.0370	0.0059	0.554	0.04246	1
Belgium	15	56	42	40	41	47	52	55	88	0.005	0.007	0.006	0.004	0.004	0.004	0.004	0.002	0.003	0.038	0.0334	0.0051	0.649	0.03980	2
Finland	19	65	50	27	31	42	49	84	92	0.007	0.008	0.007	0.003	0.003	0.004	0.004	0.003	0.003	0.040	0.0343	0.0062	0.535	0.03958	3
Luxembourg	21	52	42	27	40	35	57	58	92	0.007	0.006	0.006	0.003	0.003	0.003	0.004	0.002	0.003	0.038	0.0330	0.0053	0.619	0.03911	4
Slovakia	22	51	44	22	39	44	42	70	94	0.008	0.006	0.006	0.002	0.003	0.004	0.003	0.002	0.004	0.038	0.0327	0.0058	0.570	0.03830	5
Latvia	26	39	48	6	40	44	41	52	97	0.009	0.005	0.007	0.001	0.003	0.004	0.003	0.002	0.004	0.037	0.0317	0.0053	0.620	0.03780	6
Lithuania	14	39	56	7	42	54	43	30	93	0.005	0.005	0.008	0.001	0.004	0.005	0.003	0.001	0.003	0.034	0.0299	0.0045	0.739	0.03716	7
Slovenia	13	39	14	27	36	65	62	2	86	0.005	0.005	0.002	0.003	0.003	0.006	0.004	0.000	0.003	0.031	0.0272	0.0033	1.000	0.03709	8
France	18	61	44	23	23	35	40	69	91	0.006	0.007	0.006	0.002	0.002	0.003	0.003	0.002	0.003	0.036	0.0303	0.0056	0.584	0.03603	9
Sweden	11	59	39	44	35	38	39	70	86	0.004	0.007	0.006	0.004	0.003	0.003	0.003	0.002	0.003	0.036	0.0301	0.0055	0.601	0.03598	10
Italy	17	37	62	13	30	27	54	77	98	0.006	0.005	0.009	0.001	0.003	0.002	0.004	0.002	0.004	0.036	0.0295	0.0062	0.535	0.03477	11
Norway	6	48	61	13	40	50	38	85	85	0.002	0.006	0.009	0.001	0.003	0.004	0.003	0.003	0.003	0.034	0.0285	0.0059	0.556	0.03402	12
Iceland	20	47	40	26	12	43	30	88	92	0.007	0.006	0.006	0.002	0.001	0.004	0.002	0.003	0.003	0.034	0.0280	0.0063	0.524	0.03318	13
Poland	20	46	20	13	25	49	38	38	96	0.007	0.006	0.003	0.001	0.002	0.004	0.003	0.001	0.004	0.031	0.0260	0.0048	0.682	0.03274	14
Portugal	12	40	31	35	42	46	43	91	97	0.004	0.005	0.004	0.003	0.004	0.004	0.003	0.003	0.004	0.034	0.0277	0.0066	0.501	0.03262	15
Denmark	6	51	48	36	27	28	45	78	83	0.002	0.006	0.007	0.003	0.002	0.002	0.003	0.003	0.003	0.032	0.0267	0.0056	0.586	0.03246	16
Malta	11	39	42	26	29	41	43	84	93	0.004	0.005	0.006	0.002	0.003	0.004	0.003	0.003	0.003	0.033	0.0264	0.0062	0.532	0.03160	17
Netherlands	13	40	40	29	7	48	37	75	90	0.005	0.005	0.006	0.003	0.001	0.004	0.003	0.002	0.003	0.031	0.0255	0.0058	0.569	0.03108	18
Austria	18	37	28	30	25	36	32	86	89	0.006	0.005	0.004	0.003	0.002	0.003	0.002	0.003	0.003	0.032	0.0254	0.0061	0.539	0.03072	19
Estonia	17	34	52	8	18	42	19	75	94	0.006	0.004	0.007	0.001	0.002	0.004	0.001	0.002	0.004	0.031	0.0250	0.0059	0.554	0.03046	20
Spain	11	34	34	30	28	30	39	45	93	0.004	0.004	0.005	0.003	0.002	0.003	0.003	0.001	0.003	0.029	0.0236	0.0049	0.667	0.03021	21
Croatia	14	32	27	13	59	20	32	67	94	0.005	0.004	0.004	0.001	0.005	0.002	0.002	0.002	0.004	0.029	0.0231	0.0057	0.579	0.02884	22
Greece	15	30	23	40	29	23	24	79	96	0.005	0.004	0.003	0.004	0.003	0.002	0.002	0.003	0.004	0.028	0.0223	0.0061	0.536	0.02763	23
United King	9	28	21	8	13	72	46	87	84	0.003	0.003	0.003	0.001	0.001	0.006	0.003	0.003	0.003	0.027	0.0211	0.0060	0.553	0.02660	24
Ireland	10	35	34	24	18	29	29	82	89	0.004	0.004	0.005	0.002	0.002	0.003	0.002	0.003	0.003	0.027	0.0212	0.0060	0.551	0.02660	25
Bulgaria	14	39	29	11	23	28	14	52	98	0.005	0.005	0.004	0.001	0.002	0.002	0.001	0.002	0.004	0.026	0.0204	0.0054	0.615	0.02645	26
Czech Repub	19	33	18	16	20	15	29	66	91	0.007	0.004	0.003	0.002	0.002	0.001	0.002	0.002	0.003	0.026	0.0200	0.0055	0.595	0.02586	27
Hungary	18	26	11	8	20	44	38	85	96	0.006	0.003	0.002	0.001	0.002	0.004	0.003	0.003	0.004	0.027	0.0202	0.0063	0.520	0.02535	28
Romania	12	27	19	17	15	19	20	91	100	0.004	0.003	0.003	0.002	0.001	0.002	0.001	0.003	0.004	0.023	0.0163	0.0067	0.493	0.02116	29
Turkey	11	36	15	12	18	16	17	91	95	0.004	0.004	0.002	0.001	0.002	0.001	0.001	0.003	0.004	0.022	0.0158	0.0065	0.507	0.02077	30
Former Yugo	11	20	10	13	14	9	18	80	99	0.004	0.002	0.001	0.001	0.001	0.001	0.001	0.003	0.004	0.019	0.0123	0.0063	0.524	0.01747	31
Cyprus	11	16	9	22	9	5	12	98	97	0.004	0.002	0.001	0.002	0.001	0.000	0.001	0.003	0.004	0.018	0.0113	0.0068	0.485	0.01610	32
Sum	485	1287	1098	698	879	1163	1180	2272	2956	0.172	0.157	0.157	0.067	0.076	0.102	0.085	0.073	0.111	1.000	0.8160	0.1840	18.677	1.0000	
Sum multiplied from the significance of	83	202	172	47	67	119	100	166	328															
					Sum equal to 1284																			

For the comparison of trade and manufacturing enterprises different criteria are used, including specific factors, which characterizing ability of enterprise to meet high risk and use security information systems.

The results of the study show that Belgium manufacturing and Germany trade enterprises are the most active in adopting information systems. Comparing Belgium manufacturing enterprises with other manufacturing enterprises, it is noted that there are more active enterprises in Belgium (the number of active enterprises is 0.82-1.69 times greater than industry average). This means that it is necessary to improve the ability of other manufacturing enterprises to adopt information systems. Comparing Germany trade enterprises with other trade enterprises, it is noted that there are more active enterprises in Germany (the number of active enterprises is 1-2.1 times greater than industry average). This means that ability of other enterprises to adopt information systems is even higher when for manufacturing industry.

Finally, the set of criteria is tested by using data of enterprises located in 32 countries. The survey is conducted to reveal the ability of enterprises for the adoption of information systems. The comparison of manufacturing and trade enterprises shows that continual adoption have imbalances between enterprises, located in Netherlands, Austria, Finland, Portugal, Greece, Czech Republic and Iceland. Especially differences are seen in Iceland and Czech Republic.

It is noted that suggested profile helps to compare enterprises from different countries and their ability to adopt information systems and might be useful for authors who analyze to adoption of information systems by enterprises.

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