

COMPARATIVE STUDY REGARDING DEVELOPMENT OF INFORMATION SOCIETY IN ROMANIAN ENTERPRISES. A MULTIMETHOD ANALYSIS

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Abstract

The impact of information society – as a factor of organizational change (Dovenport, 2003) on performance of firms is increasingly approached and measured – by means of statistical indicators – in the specialty literature, developing in a fast pace and influencing all business sectors, from industrial, services, either touristic, medical, educational or public administration. Within the EU – 28 countries positive evolutions were registered in 2014 compared with 2010 related to adoption of e-business technologies in enterprises. In Romania, the development of indicators concerning information society compared to that of EU-28, have registered growth rates much higher than those of EU-28, EU-27 or Euro area, especially following the post-accession to the European Union. The average values of IT&C indicators for Romania - according to Eurostat – are much more different compared to EU-28 and, in this study we have applied statistical testing methods as regards these differencies by means of the Student t test. The results have shown that for two of the seven indicators of information society there are significant differencies, for share of enterprises' turnover on e-commerce and enterprises having received orders online (at least 1%), respectively.

Key words: comparative analysis, European Union – 28 countries, information society, Romania t test.

JEL Classification: C10, C12, L86, M15, O11, O14, P51

I. INTRODUCTION

The impact of information society – as a factor of organizational change (Dovenport, 2003) on performance of firms is increasingly approached and measured – by means of statistical indicators – in the specialty literature, developing in a fast pace and influencing all the business sectors, from industrial, services, either touristic, medical, educational or public administration.

Practically, in a global society, in order to be successful, *organizations need high quality information and to provide always added value better than competitors when it is about quality, price and services* (Pollard, 2006). Hit and Brynjolfsson (1996) sustained that while TIC helps increase productivity and excess consumption, they cannot necessarily increase the firm's profitability. Nevertheless a direct and cause relation has been found between performances of organizations and IT investments (Grandon and Pearson 2004).

Within the EU – 28 countries positive evolutions were registered in 2014 compared to 2010 related to *adoption of e-business technologies in enterprises* according to fig. 1.

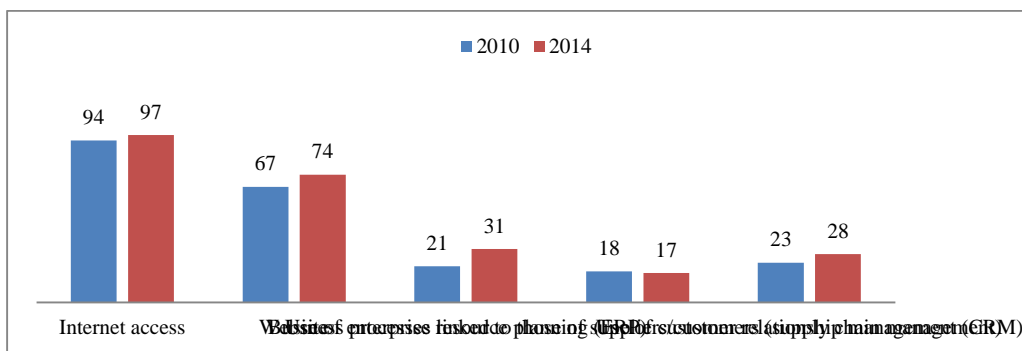


Figure 1 - Adoption of e-business technologies in enterprises, EU-28, 2010 and 2014 (% of enterprises)

(Source: http://ec.europa.eu/eurostat/product?code=isoc_ci_eu_en2&language=en&mode=view)

It is noticed that, the highest percentage increase is given by *websites* from 64% to 74 % and for the indicator *use of enterprises resources planning (ERP)*, from 21% to 31%, these aspects proving both the strategy of increasing the firm visibility and that of planned use the firm resources.

According to fig. 2, it can be noticed an evolution in 2008 – 2013, concerning the EU – 28 countries of *e-commerce sales and purchases*, respectively: *enterprises making e-commerce sales (% of enterprises)* from 13% in 2008 to 18% in 2013, *enterprises making e-commerce purchases (% of enterprises)* from 32% in 2008 to 38% in 2013, *turnover from e-commerce (% of turnover)* from 12% to 15%, its increase taking place under a full economic recession within the entire European Union.

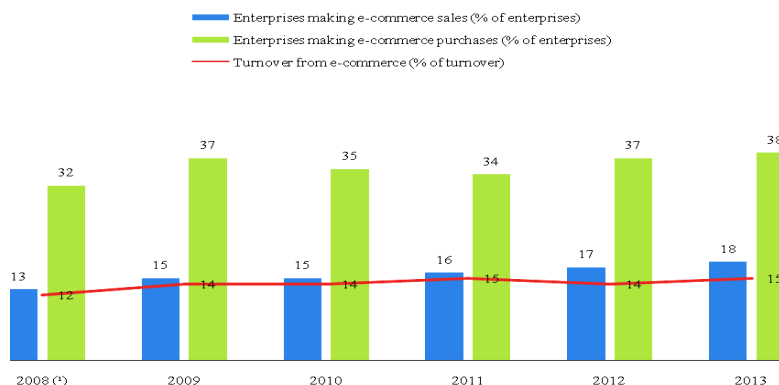


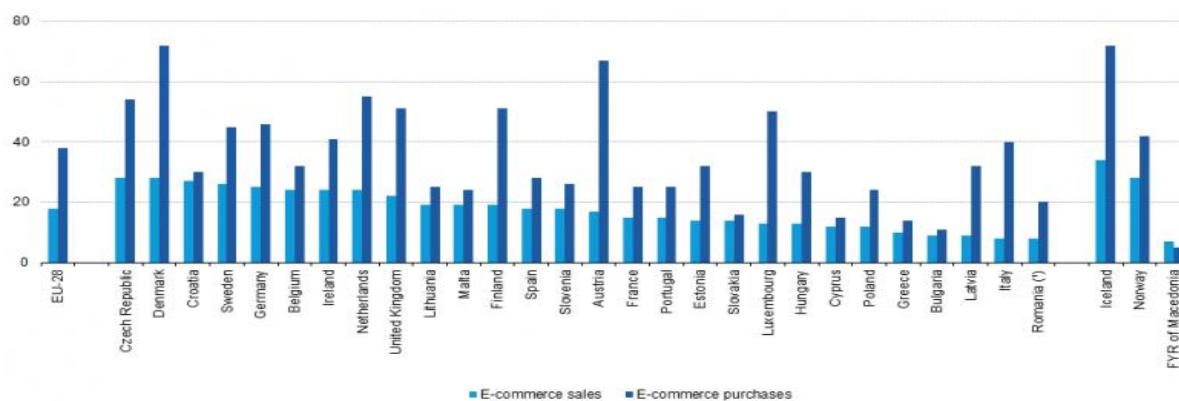
Figure 2 - E-commerce sales and purchases, EU-28 countries, 2008 – 2013

(Source: http://ec.europa.eu/eurostat/product?code=isoc_bde15dec&language=en&mode=view and http://ec.europa.eu/eurostat/product?code=isoc_ec_evaln2&language=en&mode=view)

As regards these evolutions, we shall analyze, in the following paragraph, the comparative situation of information society indicators in Romania compared to EU- 28 countries, EU – 27 countries and Euro area.

II. ADOPTION OF E-BUSINESS TECHNOLOGIES IN ROMANIAN ENTERPRISES COMPARED WITH EU-28 COUNTRIES

A visual positioning of Romania’s place within the member countries of European Union related to the online commerce of the firms can be seen in fig. 3, from where it clearly results that Romania occupies the last positions, for these indicators.



(*) E-commerce purchases: 2012.
Source: Eurostat (online data code: isoc_bde15dec)

Figure 3 - E-commerce purchases and sales, 2013 (% of enterprises)

(Source: http://ec.europa.eu/eurostat/product?code=isoc_bde15dec&language=en&mode=view)

Related to *enterprises with fixed broadband access*, in fig. 4 it can be noticed that, though Romania

(36.73) is below the averages of EU – 28 (85.25), EU – 27 (78,85) or Euro area (78.42), in 2003 – 2014 it registered an average growth rate of 27.74% compared with only 2.58% for EU – 28, a growth rate of 7.17% for EU-27 and 7.78% for Euro area.

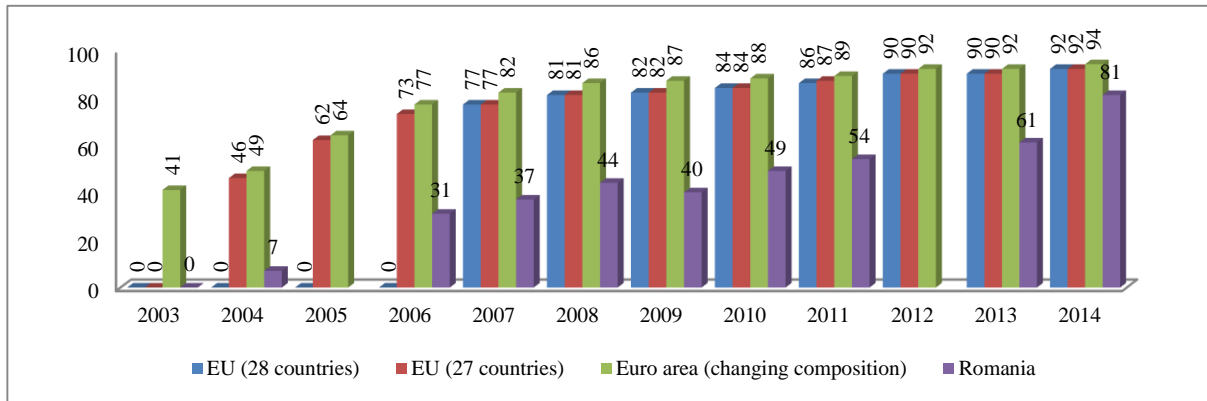


Figure 4 - Enterprises with fixed broadband access for Romania, EU-28, EU-27 and Euro area
(Source: made by the authors based on the Eurostat data)

Related to the *share of enterprises' turnover on e-commerce*, Romania also registers an average growth rate that is much higher in 2003 – 2014 (fig. 5), 25.1% respectively compared to that of EU-28 that is 4.53%, of EU-27 that is 5.24% or of Euro area that is 5.75%. Concerning this indicator, Romania's average for the period concerned is only 3.33% that is much lower than that of EU-28 that is 13.38%.

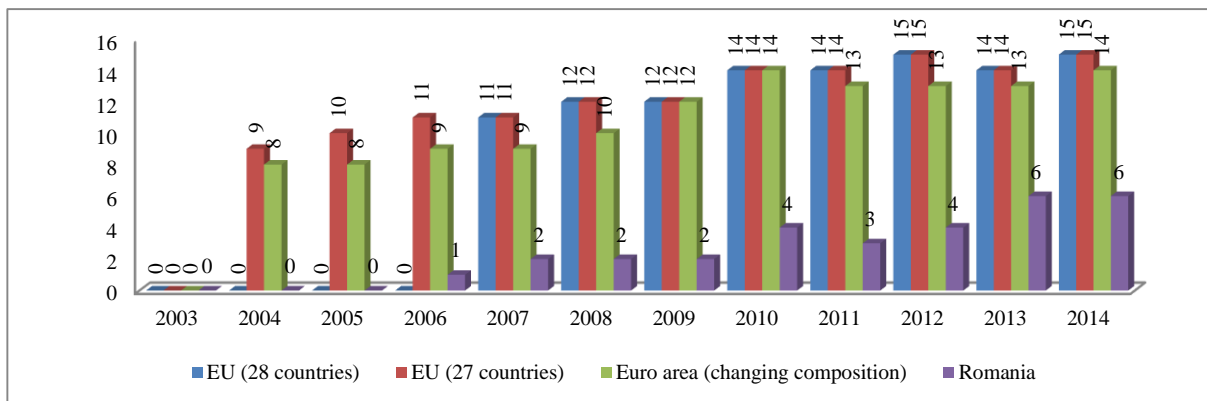


Figure 5 - Share of enterprises' turnover on e-commerce for Romania, EU-28, EU-27 and Euro area
(Source: made by the authors based on the Eurostat data)

Related to *enterprises having received orders online (at least 1%)*, Romania (fig. 6) has an average growth rate of 19.6% compared to EU-28 that remained steady during the whole period, or with the average rate of 1,4% registered within EU-27 or that of 7.17% within Euro area.

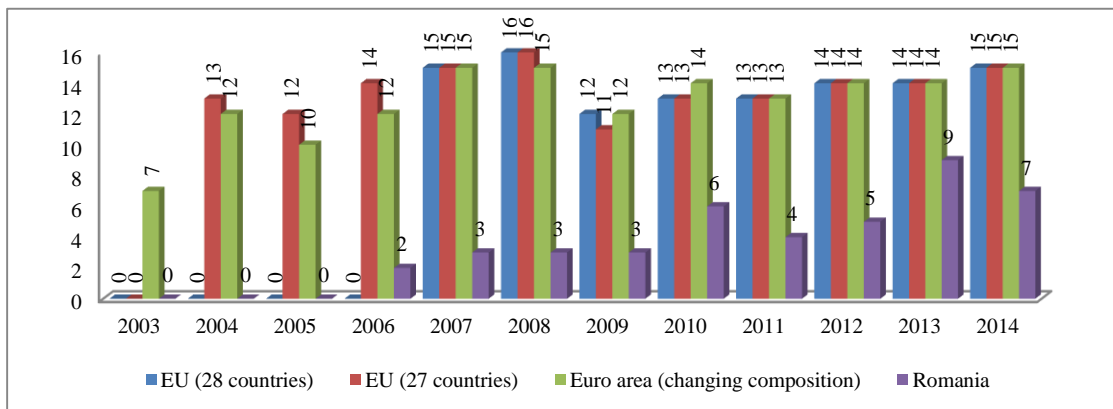


Figure 6 - Enterprises having received orders online for Romania, EU-28, EU-27 and Euro area
(Source: made by the authors based on the Eurostat data)

Concerning *enterprises having purchased online (at least 1%)*, Romania has registered an average growth rate of 7.2% compared to EU-28 that (fig. 7), for 2003 – 2014, registered an average decline rate of 3.87%, or that of EU-27 that is 1.66%. An average growth rate of 8.8% was registered within Euro area.

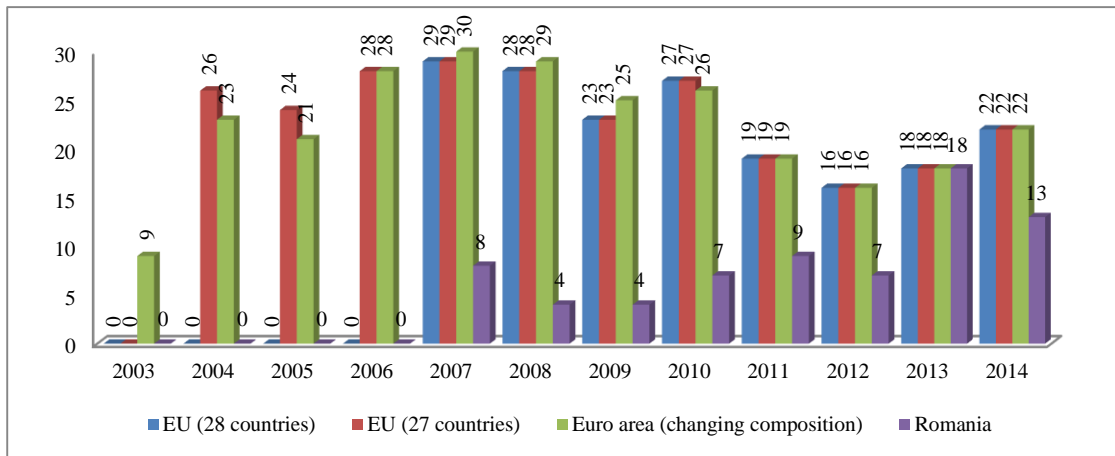


Figure 7 - Enterprises having purchased online (at least 1%) for Romania, EU-28, EU-27 and Euro area
(Source: made by the authors based on the Eurostat data)

For the indicator *Enterprises sharing electronically information on sales or on purchases with the software used for any internal function* (fig. 8), Romania registered an average growth rate of 3.4% that is quite close to that of EU-28 that is 1.8% or that of Euro that is 1.1%, data regarding Romania’s post-accession to the European Union when the presence of multinational companies increased on the Romanian market, for this indicator Romania has not registered so high differences compared to its average and within EU-28, EU-27 or Euro area.

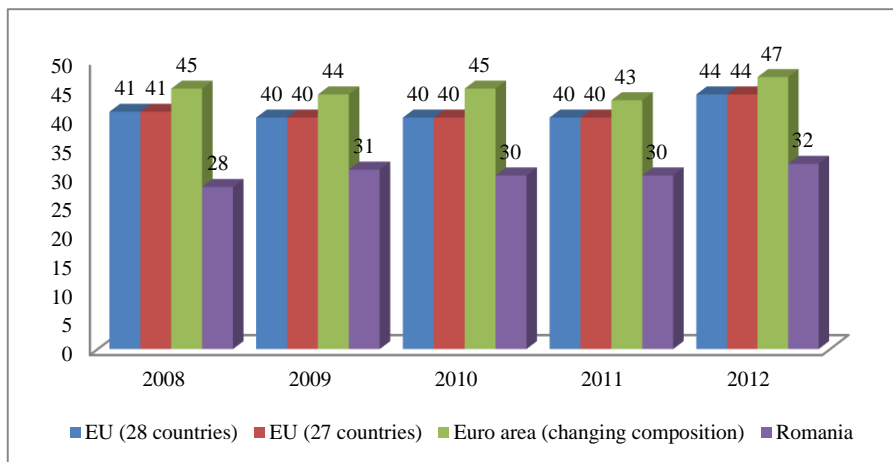


Figure 8 - Enterprises sharing electronically information on sales or on purchases with the software used for any internal function for Romania, EU-28, EU-27 and Euro area
(Source: made by the authors based on the Eurostat data)

As regards the indicator *enterprises whose business processes are automatically linked to those of their suppliers and/or customers* (fig. 9), Romania registered the same growth rate, of 1.5% the same as EU-28, EU-27 and Euro area, in 2008 – 2014. However, the yearly development of this indicator for Romania is different, because from a percentage of 7% in 2008 rose to 10% in 2009, then to 13% in 2010 and to 14% in 2012, running back to the level of the year 2014 namely 8%. In EU-28, this indicator registered decreases in 2009 (from 16% to 15%) and in 2014 (from 23% to 17%).

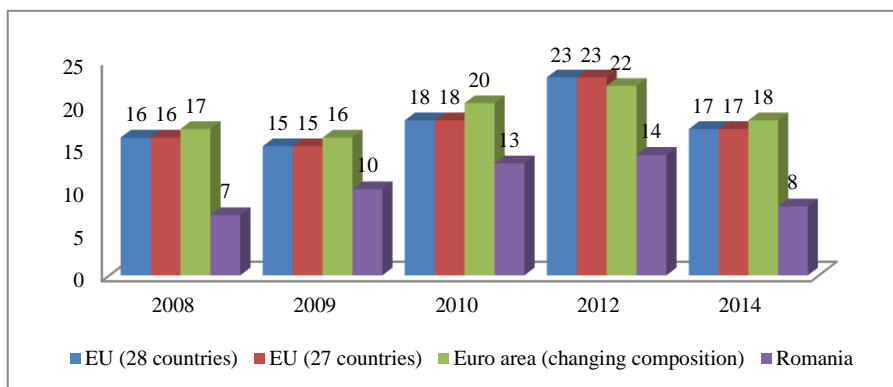


Figure 9 - Enterprises whose business processes are automatically linked to those of their suppliers and/or customers for Romania, EU-28, EU-27 and Euro area

(Source: made by the authors based on the Eurostat data)

The last indicator, *enterprises using software solutions, like CRM to analyze information about clients for marketing purposes* (fig.10), Romania registered a slack following the post-accession to the European Union, compared to EU-28 that registered (as EU-27) an average growth rate of 2.7% or of Euro area that was 1.7%.

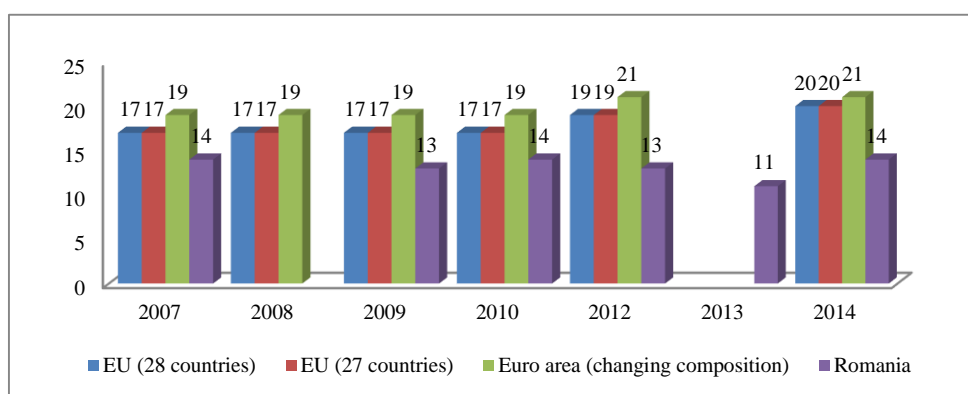


Figure 10 - Enterprises using software solutions, like CRM to analyze information about clients for marketing purposes for Romania, EU-28, EU-27 and Euro area

(Source: made by the authors based on the Eurostat data)

From the aforementioned analyses we may conclude that there are major differences between development of Romania’s information society indicators compared to that of EU-28 as noticed from the descriptive statistical results in table 1. In order to analyze these differences with inferential statistics tools we have used the methods presented in the following paragraph, the results being shown and discussed in paragraph IV of this paper.

Table 1 - Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
1. Enterprises with fixed broadband access				
EU_28	84.57	7	5.224	1.974
Romania	52.29	7	15.097	5.706
2. Share of enterprises' turnover on e-commerce				
EU_28	13.38	8	1.506	.532
Romania	3.63	8	1.685	.596
3. Enterprises having received orders online (at least 1%)				
EU_28	14.00	8	1.309	.463
Romania	4.88	8	2.167	.766
4. Enterprises having purchased online (at least 1%)				
EU_28	22.75	8	4.892	1.729
Romania	8.75	8	4.713	1.666
5. Enterprises sharing electronically information on sales or on purchases with the software used for any internal function				
EU_28	41.00	5	1.732	.775
Romania	30.20	5	1.483	.663
6. Enterprises whose business processes are automatically linked to those of their suppliers and/or customers				

EU_28	17.80	5	3.114	1.393
Romania	10.40	5	3.050	1.364
7. Enterprises using software solutions, like CRM to analyze information about clients for marketing purposes				
EU_28	17.83	6	1.329	.543
Romania	12.67	6	2.733	1.116

III. DATA, METHODOLOGY AND HYPOTHESIS

Data used in this study are statistical data according to EUROSTAT for the 28 European Union member countries are:

- enterprises with fixed broadband access - % of enterprises with at least 10 persons employed in the given NACE sectors for 2003 – 2014 period
- enterprises having received orders online (at least 1%) - % of enterprises with at least 10 persons employed in the given NACE sectors, by size class, for 2003 – 2014 period
- enterprises having purchased online (at least 1%) - % of enterprises with at least 10 persons employed in the given NACE sectors, by size class, for 2003 – 2014 period
- share of enterprises’ turnover on e-commerce – all sector for the period 2003 – 2014
- enterprises sharing electronically information on sales or on purchases with the software used for any internal function, for 2008 – 2012 period
- enterprises whose business processes are automatically linked to those of their suppliers and/or customers, for 2008 – 2014 period
- enterprises using software solutions, like CRM to analyze information about clients for marketing purposes, for 2007 – 2014 period.

For comparative analyses in the introduction paragraph, the following has been calculated:

- *average level*, based on the simple arithmetic mean;
- *average growth or decline rate*, using the formula:

$$\bar{R} = (\bar{I} - 1) * 100 \quad (1)$$

As the results of descriptive statistics have shown very high value differences between Romania’s indicators compared to those of European Union EU – 28 countries, we have used the *Student t test for paired samples* in order to test if these value differences between averages are statistically significant. The t test (Student) is one of the most common statistical tests to compare averages for paired samples as is the case of these comparative analyses and constitutes an important tool for statistical inference whose results can be the information basis in developing the marketing strategies to differentiate any of the four components of the marketing mix of companies operating on the durable goods market (Gabor et al., 2011, Gabor, 2009).

The *hypotheses* tested by means of the Student t test are shown structured in table 3, column 1.

IV. RESULTS AND DISCUSSIONS

As regards the results presented in table 1, column 2, that shows the values of the average level of information society indicators, very high differences are noticed between the indicator means of Romania and those of EU-28. Therefore it is required to test statistically the significance between these average values, testing that has carried-out by means of inferential statistics, t Student test for paired samples, respectively, its results following the application of the SPSS software being shown as a comparison between Romania and EU-28 in table 2.

Table 2 - Paired Samples Test for EU – 28 countries and Romania

Mean	Std. Deviation	Std. Error Mean	Paired Differences		t	df	Sig. (2-tailed)
			95% Confidence Interval of the Difference				
			Lower	Upper			
1. Enterprises with fixed broadband access							
32.286	10.388	3.926	22.679	41.893	8.223	6	.000
2. Share of enterprises' turnover on e-commerce							
9.750	1.035	.366	8.885	10.615	26.642	7	.000
3. Enterprises having received orders online (at least 1%)							
9.125	2.475	.875	7.056	11.194	10.429	7	.000
4. Enterprises having purchased online (at least 1%)							
14.000	8.211	2.903	7.135	20.865	4.822	7	.002

5. Enterprises sharing electronically information on sales or on purchases with the software used for any internal function							
10.800	1.643	.735	8.760	12.840	14.697	4	.000
6. Enterprises whose business processes are automatically linked to those of their suppliers and/or customers							
7.400	2.191	.980	4.680	10.120	7.553	4	.002
7. Enterprises using software solutions, like CRM to analyse information about clients for marketing purposes							
5.167	1.835	.749	3.241	7.092	6.897	5	.001

Concerning the results shown in table 2 it is noticed that, all this results are statistically significant (the last table column). The hypotheses tested and final conclusions according to the results are presented in table 3.

Table 3 – Results for t test

Null hypothesis tested H_0	$t_{calculated}$	$t_{theoretical}$	Conclusions
1. There are significant differences between Romania and EU-28 regarding means of enterprises with fixed broadband access	8.223	9.082	H_0 is rejected
2. There are significant differences between Romania and EU-28 regarding means of share of enterprises' turnover on e-commerce	26.642	7.885	H_0 is accepted
3. There are significant differences between Romania and EU-28 regarding means of enterprises having received orders online (at least 1%)	10.429	7.885	H_0 is accepted
4. There are significant differences between Romania and EU-28 regarding means of enterprises having purchased online (at least 1%)	4.822	7.885	H_0 is rejected
5. There are significant differences between Romania and EU-28 regarding means of enterprises sharing electronically information on sales or on purchases with the software used for any internal function	14.697	15.544	H_0 is rejected
6. There are significant differences between Romania and EU-28 regarding means of enterprises whose business processes are automatically linked to those of their suppliers and/or customers	7.553	15.544	H_0 is rejected
7. There are significant differences between Romania and EU-28 regarding means of enterprises using software solutions, like CRM to analyse information about clients for marketing purposes	6.897	11.178	H_0 is rejected

Concerning conclusions related to the null hypotheses expressed within the study, it results that, only for the following two indicators there are statistically significant differences between Romania's average and that of the EU-28 countries, the values calculated by means of SPSS (column 2 of table 3) being higher compared with theoretical values of the Student statistics:

- share of enterprises' turnover on e-commerce
- enterprises having received orders online (at least 1%)

For all the other information society indicators, the calculated values of the Student statistics have been lower than the theoretical ones, thus resulting the rejection decision of null hypothesis and therefore non-existence of a statistically significant difference between averages registered by Romania compared to the average values of the EU-28 countries.

V. CONCLUSION

This comparative study has shown by means of statistical methods, descriptive statistics, time series statistics and inferential statistics respectively, statistically significant differences between information society indicators in Romania, compared to those in the EU- 28 countries, EU – 27 countries and those in Euro area. We have thus emphasized that, though Romania is on one of the last places as regards these indicators, their growth rate, especially following post-accession, is a positive one. Therefore Romania has registered:

- An average growth rate of 27.74% compared with only 2.58% for EU – 28 as regards indicator enterprises with fixed broadband access;
- An average growth rate of 25.1% compared to that of EU-28 that is 4.53%, for indicator share of enterprises' turnover on e-commerce ;
- An average growth rate of 19.6% compared to EU-28 that stagnated for indicator enterprises having received orders online (at least 1%);
- An average growth rate of 7.2% compared to EU-28 that registered an average decline rate of 3.87%, for indicator enterprises having purchased online (at least 1%).

Of all differences between Romania's averages and those of the UE-28 countries for information society indicators, only for share of enterprises' turnover on e-commerce and enterprises having received orders online (at least 1%) statistically significant differences have been registered between these average values, id est for 2 of the three indicators for which Romania has shown a fast development.

The results of this study thus completes the conclusions of another study carried-out by the authors (Cîmpian et al., 2014) and proved the results of Palvia (1996) according to which the ITC technologies are used

intensively by the large organizations, aspect proved by the fact that, the order of independent variables in making the model reveals *average number of employees* in the first position, with direct effects on creation of added value according to Pollard (2006).

The development of information society is also very important as the firms no matter the field they work in such as tourism (Firoiu and Croitoru, 2015), industry, services, etc. can create a competitive advantage on the market and can also increase productivity (Cocalia, 2015) and efficiency in the context of globalization.

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