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Some Practical Aspects Regarding the Development of Environmental Friendly Activities in the IT Business

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Abstract

The unprecedented expansion of the Internet within the business environment over the last few years has played a significant role in the process of developing green activities within modern enterprises. Thus, the handover of traditional economic activities in the online domain has generated an impressive increase of speed in the process of carrying out business operations. IT companies are employing several green activities which are expected to optimize their current operations, such as: e-mails and the cutting down on paper use, the management of on-line documents through cloud computing, teleworking, Webinars etc. The paper relies on some interesting data sets resulted from an exploratory study regarding the use of green activities in several IT Romanian companies.

Keywords: *cloud computing; green activities; teleworking; Webinars*.

JEL Classification: *M15; Q 56.*

Introduction

The spectacular technological evolution in the IT area, together with its impact on society, represents a key issue that has produced a rich body of literature in the last few years (Chan, 2000; Kohli and Devaraj, 2003; Mathis and Sambamurthy, 2011). Taken in this context, the unprecedented expansion of the Internet within the business environment has played a significant role in the process of developing green activities within modern enterprises (Moore and Manring 2009). At present, green IT refers to information technology and system initiatives and programs that address environmental sustainability (Mishra A. and Akman I. 2014). It has been argued that IT holds the promise of being instrumental in combating the negative environmental effects of the world's rapidly developing economies (Erek et al, 2009).

Thus, the dynamics of IT innovation in various sectors of industry and social life brings about serious changes including the requirement for companies to innovate in order to succeed in a world of 'Internet of Everything', a world that will radically change a man's life, meaning that the technology will be implemented if it meets a series of conditions related to environmental protection, to health and safety at work, to energy saving and faster communication; all these interrelated facets are considered part of Green IT activities (Cioca et al., 2009; Isac and Isac; 2014; Isac et al., 2017). In other words, Green Computing discusses the options to support critical computing needs in a sustainable manner by reducing strains on resources and

environment (Soomro and Sarwar, 2012). Besides many positive aspects that are correlated with the above-mentioned evolutions, it has been recognized that the IT may bring into play detrimental influences upon environmental fingerprints of various types of organizations (Campbel et al 2015; Tracy et al, 2011).

The main advantages and positive effects of green IT activities, as well as the drawbacks associated with the effective implementation of these activities, are displayed in table 1. Thus, various types of green activities (as they are described in the literature), are reviewed, by listing the most recent scientific papers which tackle, from all different angles, these new emerged issues of modern business.

Table 1. Green activities – advantages and disadvantages

No	Green activity	Advantages and positive effects of green IT activities	Diminished or cancelled disadvantages
Green activities related to data sending and managing			
1	**Emails and instant messaging** (Claeyssen 2009, Wilson 2015)	Immediate transmission, creation of templates, the possibility of structuring information, simultaneous transmission to hundreds of recipients.	o Writing letters, addresses and printing them o Require a courier for stamping and sending letters
2	**Skype, WhatsApp** (Kurch 2009, Janghorban et al, 2014, Deakin and Wakefield 2013)	o Skype encourages interviewees who have time and place limitations for face-to-face interviews to participate in research conducting debates or discussions and, at the same time, doing other activities. o The instrument allows significant time saving, as compared to writing an email or making a phone call.	o Reducing radiations caused by the use of mobile phones
3	**Webinar** (Wang and Hsu 2008, Zoumenou et al 2016)	o Information is accessed simultaneously by a large number of users wherever they are; o It enables to organize a meeting where participants can see each other face-to-face and to benefit from the results of an effective discussion and/or debate; o It creates flexible jobs in terms of geographical areas and time, jobs that are suitable for various fields such as trade, managerial consultancy, IT services etc.	o Commuting between certain subsidiaries or travelling with means of transport to different locations. o Reducing greenhouse gas emissions relating to travel and increasing profit margins due to lower costs of office upkeep (heating, lighting, etc.).
4	**eLearning** (Arkorful and Abaidoo 2015; Mohammadi 2015)	Flexibility that encourages the student's own learning style.	oIt eliminates costs and inconveniences caused by the fact that the instructor and the learner had to be in the same place.
5	**Teleworking** (Egbuta et al 2017, Karia and Asaari 2016)	o It creates a better balance between work and private life; o It increases the labour productivity as employees can manage their time better, feeling more inspirational and more energetic.	o It eliminates the time spent in traffic to/from the office; o It minimizes administrative expenses - office rents, utilities, consumables; o It minimizes stress caused by employee relations (www.pgi.com).

Table 1 (cont.)

6	**Cloud Computing** (Raja and Krishnan 2016; González-Martínez et al 2015; Quayoom 2017; Raja and Krishnan, 2016)	o It enables the synchronization of data when the user uses multiple cloud-connected devices (e.g. a tablet, notebook, laptop or smartphone); o It increases computing speed and storage capacity without further investments in configuration; o It makes possible to browse a physical shelf of books, CDs or DVDs or to choose to take out an item or scan a bar code into his/her mobile device.	o It eliminates the risk of losing information and documents; o It reduces or eliminates rooms used for archiving documents and implicitly it contributes to the cutting down of the related costs.

From the managerial point of view, we must take into consideration the indisputable advantages associated with the implementation of green IT activities within modern enterprises, which certainly counterbalances their drawbacks. In order to take a closer look on the issue, we were interested in conducting an online survey on the utilisation of the indicators presented in Table 1, within several Romanian companies from the IT services domain, which were located in Hunedoara county. The paper is organized as follows: section two describes the methodology employed within the paper; section three discusses the main results obtained by performing the basic statistical analysis of the sample responses and section four concludes.

Methodology

The main body of the questionnaire used within our on-line survey included a group of questions which were aimed at analysing the way many employees in the field of IT services have used specific indicators of green activities (ITIEP – IT Indicators for Environmental Protection) such as:

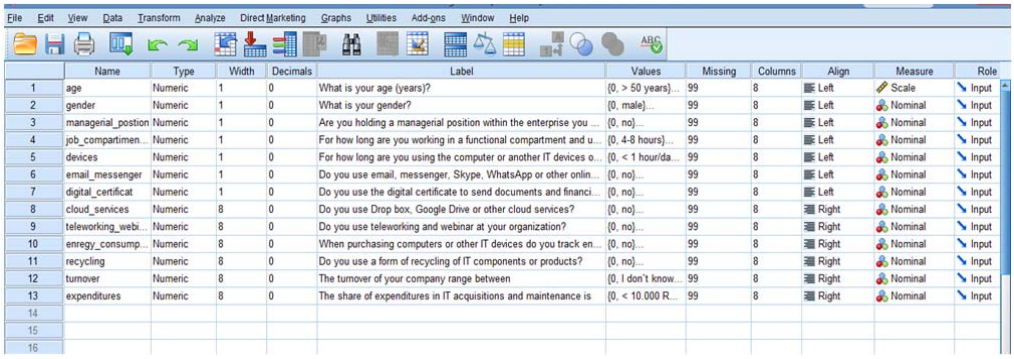
- email, messenger, Skype, WhatsApp or other messaging services - N_1;
- the digital certificate for the transmission of documents and financial statements - N_2;
- Dropbox, GoogleDrive or other cloud services - N_3;
- teleworking and webinar - N_4.

Likewise, we daunted by N_5 - the responders' interest towards saving the power used by IT equipment and by N_6 - their concern regarding the recycling of IT equipment and consumables.

In order to perform data analysis, we have employed SPSS, namely the *Statistical Package for Social Sciences*. SPSS is able to import data bases from any kind of file and to operate them in order to develop diagrams, tabulated reports, plots of distributions and trends and complex statistical analysis (www.spss.com).

Our study made use of the following of SPSS facilities: *the generation of Boxplots* in order to point out the potential abnormal values or outliers; *the structure of respondents' analyses*; *cross tabulations* employed with the aim of describing the relationship between two categorical variables, as well as *correlational analyses* carried out in order to determine the strength and the direction of correlation established between two distinct variables measured on at least an interval scale (Landau and Everitt, 2004).

In the first place, we have defined our variables and entered the data from the questionnaires as it is shown in the following figure:



	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure	Role
1	age	Numeric	1	0	What is your age (years)?	{0, > 50 years}...	99	8	Left	Scale	Input
2	gender	Numeric	1	0	What is your gender?	{0, male}...	99	8	Left	Nominal	Input
3	managerial_postion	Numeric	1	0	Are you holding a managerial position within the enterprise you ...	{0, no}...	99	8	Left	Nominal	Input
4	job_compartimen...	Numeric	1	0	For how long are you working in a functional compartment and u...	{0, 4-8 hours}...	99	8	Left	Nominal	Input
5	devices	Numeric	1	0	For how long are you using the computer or another IT devices o...	{0, < 1 hour/da...	99	8	Left	Nominal	Input
6	email_messenger	Numeric	1	0	Do you use email, messenger, Skype, WhatsApp or other onlin...	{0, no}...	99	8	Left	Nominal	Input
7	digital_certificat	Numeric	1	0	Do you use the digital certificate to send documents and financi...	{0, no}...	99	8	Left	Nominal	Input
8	cloud_services	Numeric	8	0	Do you use Drop box, Google Drive or other cloud services?	{0, no}...	99	8	Right	Nominal	Input
9	teleworking_webi...	Numeric	8	0	Do you use teleworking and webinar at your organization?	{0, no}...	99	8	Right	Nominal	Input
10	enregy_consump...	Numeric	8	0	When purchasing computers or other IT devices do you track en...	{0, no}...	99	8	Right	Nominal	Input
11	recycling	Numeric	8	0	Do you use a form of recycling of IT components or products?	{0, no}...	99	8	Right	Nominal	Input
12	turnover	Numeric	8	0	The turnover of your company range between	{0, I don't know...	99	8	Right	Nominal	Input
13	expenditures	Numeric	8	0	The share of expenditures in IT acquisitions and maintenance is	{0, < 10.000 R...	99	8	Right	Nominal	Input
14											
15											
16											

Fig. 1. Defining variables

The second phase of our research was dedicated to the analysis of Boxplot diagrams with the help of *Analyze – Descriptive Statistics – Explore* function. The diagrams obtained for variables N_1-N_6 are displayed in the appendix of the paper. These charts showed that there were no aberrant values or values located far out of distribution (outliers) (Bucea-Manea-Țoniș R. et al, 2010).

Next, we analysed the variables related to the structure of the respondents by using the *Analyze - Descriptive Statistics - Frequencies - Statistics* function, which allowed a more detailed characterization of the sample (Constantin, 2012).

Specifically, the sample population was represented by 65 men and 35 women (S_1), 28 without and 72 with a leading position (S_2), 18 respondents fell into age groups between 20 and 30 years, while 44 respondents are aged between 30-40, 24 respondents between 40-50 years of age and 14 respondents over 50 (S_3); 75% of them work in functional compartments and 44 of them spend over 50% of the actual working time in front of the computer; 66% of them use the computer outside work too; 15% use it more than 3 hours /day, 43% use it between 1 and 3 hours/day, and 8% use the computer less than 1 hour a day (S_4).

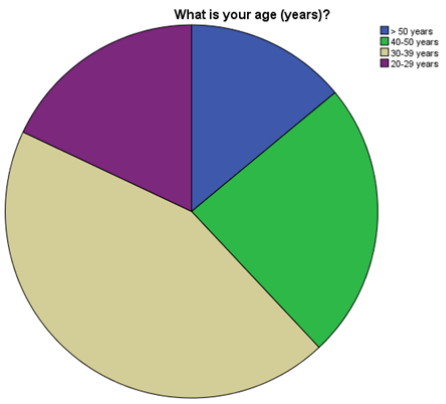


Fig. 2. S_1 Diagram

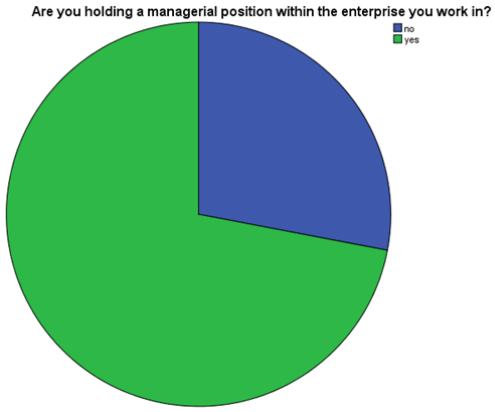


Fig. 3. S_2 Diagram

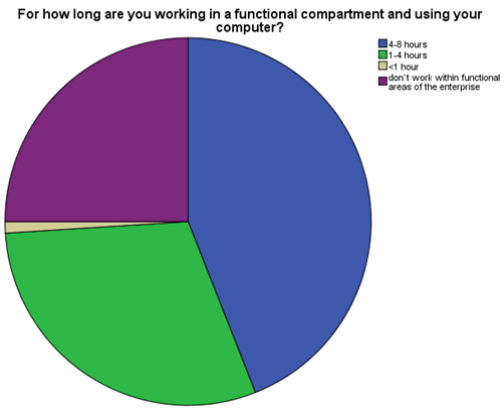


Fig. 4. S_3 Diagram

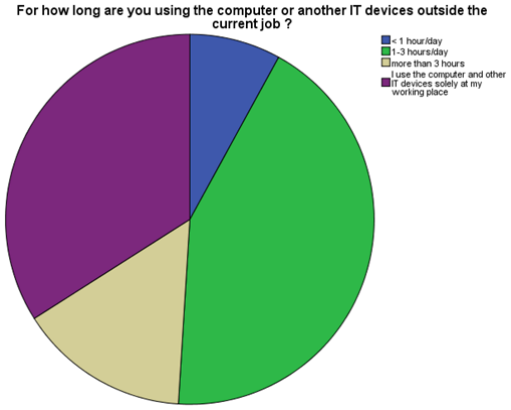


Fig. 5. S_4 Diagram

The analysis of the N_1 - N_6 dichotomy variables defined by the Analyse / Multiple Response / Define function showed that the 100 subjects used 438 green IT activities (Responses N column): 87% of the respondents used online communication services; 85% used cloud services; 75% used a form of IT device recycling; 67% used teleworking and webinar and only 28% took into consideration energy performance when purchasing IT equipment.

But using SPSS in order to analyse the data gathered from our sample means more than performing simple descriptive statistics about the main characteristics of people which took part in the study. In order to provide an overview of the relationships that may be highlighted between two categorical variables measured within our research, we have employed several Cross-tabulation procedures (Constantin, 2012). The main outcomes that occurred are presented in the following paragraph.

Results and Discussion

The *statistical analysis of the correlation between the indicators* was conducted according to a nominal variable, i.e. the personal information of the Analyse / Multiple Response / Cross-tabulation respondents (Bucea-Manea-Ţoniş R. et al, 2010).

Furthermore, the above mentioned 6 indicators were analysed according to the personal information provided by the monitored subjects. Thus, one can notice the degree of use of green IT activities reported in *male and female* independent samples. Numbers showed that of the 87 subjects that use online communication services, 30 are women and 57 are men; cloud services are used by 91% of women and 81% of men; teleworking and webinar percentages are split into 54% women and 72% men; the energy consumption of computers is considered by 22.8% of women and 30.7% of men, out of a total of 100 respondents interested in energy performance. (Table 2).

Table 2. $ ITIEP *Gender Cross-tabulation

(ITIEP)[a]		Gender category		Total
		male	female	
Total subjects		65	35	100
Do you use email, messenger, Skype, WhatsApp or other online communication services?	Count	57	30	87
Do you use the digital certificate when sending documents, financial statements?	Count	65	35	100
Do you use Dropbox, GoogleDrive or other cloud services?	Count	53	32	85
Do you use teleworking and webinar at your work place?	Count	47	19	66
When purchasing computers or other IT equipment are you interested in their energy performance?	Count	20	8	28
Do you recycle in any way IT components or products?	Count	44	27	71

Depending on *age categories*, the extent to which green activities are used showed that of the 87 subjects which use online communication services 9% are over 50 years old, 16% are between 20 and 29 years old, 19% are aged between 30-39 and the majority of 43% are aged between 30 and 39; 30 are women and 57 are men. On the other hand, cloud services are used by 91% of women and 81% of men; teleworking and webinar are used by 54% of women and 72% of men; besides, 22.8% of women and 30.7% of men out of the 28% of subjects, are interested in the energy performance of computers. Quite similar percentages, with a +/ -5% difference per age group could be recorded in the case of analysing the use of digital certificates and cloud services.

Whether holding or not a management position is not too much of an influence on the variables, one should also take into account that among the ITIEP indicators, managers are the ones who use online communication services and cloud services more frequently (Table 3).

Table 3. $ ITIEP managing position Cross tabulation

(ITIEP)[a]		Do you hold a managing position?		Total
		no	yes	
Do you use email, messenger, Skype, Whatsupp or other online communication services?	Count	23	64	87
Do you use the digital certificate when sending documents, financial statements?	Count	24	72	96
Do you use Dropbox, GoogleDrive or other cloud services?	Count	23	62	85
Do you use teleworking and webinar at your work place?	Count	16	50	66
When purchasing computers or other IT equipment are you interested in the energy performance?	Count	15	13	28
Do you recycle in any way IT components or products?	Count	21	50	71

Of the 74 subjects working within the functional compartments, 84% use online communication services and approx. 86% use cloud services regardless of the number of hours spent in front of the computer at work. According to the *$ ITIEP * job functional compartment Crosstabulation* (see table 3), the situation changes in the case of energy performance indicators and recycling tools of IT devices, where the concerns of the surveyed subjects are much lower, e.g. only 20% of those who work less than 4 hours in a functional compartment are interested in energy performance.

Tabel 3. $ ITIEP *job_functional_compartment Crosstabulation

(ITIEP)[a]		Do you working in a functional compartment?		Total
		4-8 hours	1-4 hours	
Do you use email, messenger, Skype, Whatsupp or other online communication services?	Count	37	25	62
Do you use the digital certificate when sending documents, financial statements?	Count	44	30	74
Do you use Dropbox, GoogleDrive or other cloud services?	Count	39	26	65
Do you use teleworking and webinar at your work place?	Count	30	19	49
When purchasing computers or other IT equipment are you interested in the energy performance?	Count	16	6	22
Do you recycle in any way IT components or products?	Count	30	23	53

Analysis of ITIEP indicators based on the time subjects spend in front of the computer outside of work schedule, according to *$ ITIEP * IT device_home use Crosstabulation* is relatively similar to the analysis of indicators based on the use of computers within functional compartments. Thus, 87% of them use online communication services, while 69% of them spend at least one hour outside work hours in front of the computer. In the case of cloud services, the share is of 85%; however cloud services are used outside work hours by 86% of them.

Since the variables taken into consideration are nominal, we were able *to compute the Spearman correlation* for any two variables using the Analyse / Correlate / Bi-variant function. Thus, we obtained the association tables, which showed the relations between the categorical variables.
The results showed that *the most influential variable is the age category*, where one can notice that the probability is lower than the significance level ($p<0.05$). Among the correlation coefficients computed, we found 4 values that were statistically significant:

- three (3) positive values emphasized a perfect correlation between the use of green activities and the age group of respondents. Thus, younger groups (0- corresponds to over 50 years and 3 corresponds to the age group 20-30 years) are more inclined to comprehend and use in an effective and skilful manner, modern technologies in their office work;
- one (1) negative value focuses attention on the correlation between the age group and the use of a form of recycling of the IT components or products. Thus, there is an interdependence between the two variables: the older age groups have a more open attitude towards IT products recycling, while the groups of younger age do not pay a great deal of attention to this indicator.

On the other hand, statistics showed significant correlations between the use of emails and other online communication services and the employment of digital security and cloud services, respectively.

Conclusions

The dynamics of IT&C innovation in various sectors of industry and of social life will lead to profound changes, some of which are linked to general environmental and workplace protection, to reduced energy expenditure and increased communication speed, all of which are considered a specific indicator system. In this context, the indicators which reflect a more particular form of

environmental protection allow the necessary changes to be implemented and to build a strong competitive advantage.

Our exploratory overview on the issue of employing green activities within the Romanian companies opens up an interesting avenue of research, worthy of being extended and deepened. Thus, we intend to keep our focus in the area of identifying the main determinants that influence the decision of implementing green activities rather than using an old approach for data sending and managing. Furthermore, if we would be in the position to collect data from a greater number of Romanian enterprises, we would be able to take advantage of manifold statistical tools offered by SPSS, in order to conduct correlation analyses and to reveal, on this basis, a few novel managerial strategies that would guide any player in a highly competitive market.

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Appendix

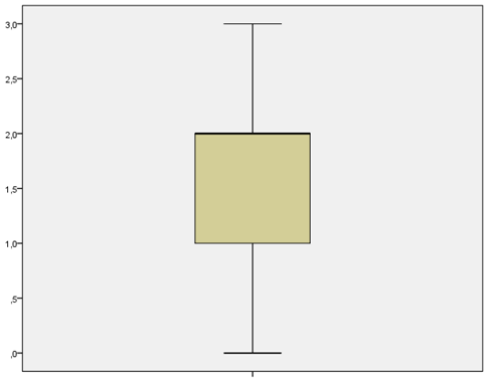
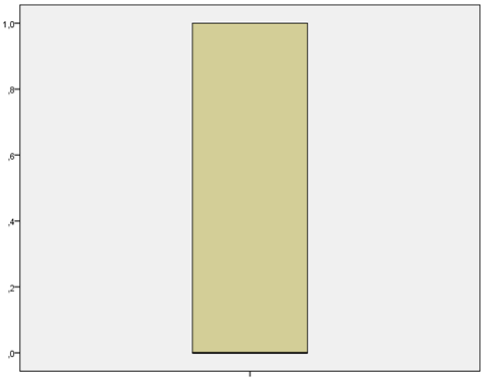


Diagram Boxplot N_1



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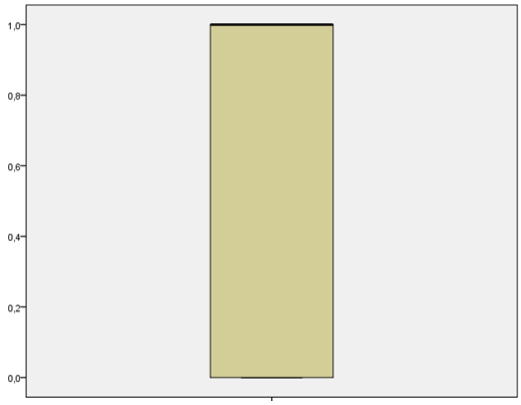

Diagram Boxplot N_3

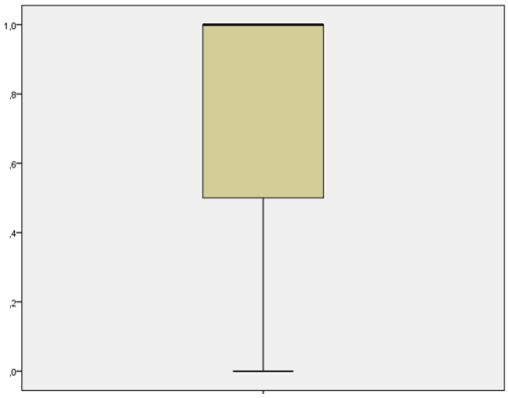

Diagram Boxplot N_4

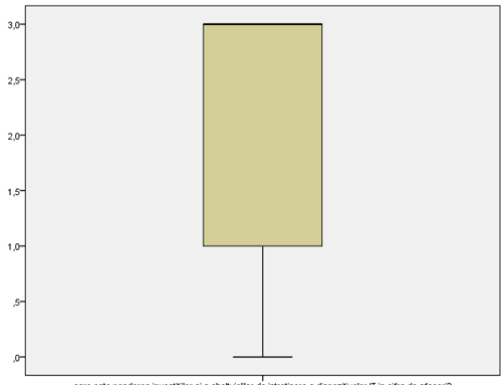

Diagram Boxplot N_5

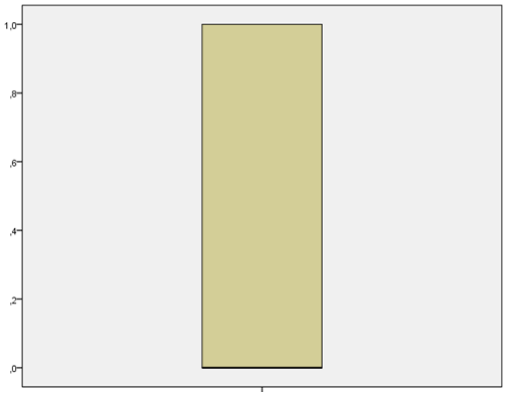

Diagram Boxplot N_6