CHALLENGES FOR BUSINESS- E-RECRUITMENT AND MODELING

Associate Professor Ph.D. Anișoara DUICĂ
"Valahia" University of Târgoviște, Romania
E-mail: anisoara_duica@yahoo.com
Assistant Professor Ph.D. Nicoleta - Valentina FLOREA
"Valahia" University of Târgoviște, Romania

Abstract. *The development of information and communication technologies had an important impact on internal processes from all the organizations, inclusive on recruitment process. Revolution of the Internet has modified the recruitment practices. Internet, because the workforce became very mobile, help the candidates and the organizations to perform. Now, recruitment is online, and the recruitment sites became a cost-efficient source, rapid, and 24/7. Recruitment using Internet will play an important role in the present world who became digital. In this article we want to present the evolution of this process, the benefits for organizations and for the candidates, but also the disadvantages, and the factors which influenced the use of e-recruitment. We also want to analyse e-recruitment at Romanian level, using simulation and modeling, determining if there is a relationship between e-recruitment as a dependent variable and some independent variables as Internet skills, computer skills, penetration rate of Internet and other factors which we consider that have an important influence on using e-recruitment.*

Key words: *business, information and communication technologies, e-recruitment.*
JEL Classification: *M12, M51.*

1. Introduction

"Internet will not try to replace the other media used for recruitment, but it is another simple tool who became necessary for HR departments from organizations "- Bruce Skillings, VP at Bernanrd Hodes Advertising, USA.

Besides other forms of external recruitment, the organizations can use their web sites (Frățilă and Duică, 2014, p.67). The Internet has braught a major change in recruitment field in the past decade acting as a link between organization and the candidates. Revoluţia internetului a modificat profund practicile de recrutare. With no doubt this domain and its new technologies had a very important impact over the the human resources management (Bellier and Trapet, 2001). One of modern business condition is to adapt rapidly to the economic environment being under continuous changing. Taday, using Internet, Intranet and Extranet, the information is quickly transfered, and the workforce become more and more mobile (Stegăroiu and Florea, 2014). Many organizations present their vacancies on their official sites (Pell, 2008). Web-sites represent a quick and cheap source of recruitment (Price, 2000) and may be very efficient in retaining talented employees on long run (Bach, 2005). It was demonstrated that if the employees are applicating their resumees, by htier own, they are tempted to stay longer with the organization, then using other recruitment sources.

Today's globalized world faces an increasing shortage of talent. Many organizations invest in their talented potential developing their digital competencies which are now among the major skills for future talents (Van Der Sluis and Van De Bunt-Kokhuis, 2009, p.2).

Recruitment helped by the use of Internet, say Bondarouk (2009) will play a very important role, as the world is becoming more digital.

In this article we present the importance of e-recruitment, its evolution and its benefits, but also the dizadvantages of using such new method. We also analyse e-recruitment at Romanian level, using simulation and modelling (Eviews 7), determining if there is a relationship between e-recruitment and some factors with influence on this

process, and we demonstrate if the distribution of used data is normal, if there is a correlation and if there is a normal distribution of residuals.

2. The importance of e-recruitment worldwide

The use of world wide web has become a powerful alternative to recruitment for organizations. For the younger generation, this task is easy, as they were born digital (Folk and Apostel, 2016, p.46). We observe that the use of Internet as recruitment medium has increased substantially in recent years.

To show this importance we present the point of views of some specialits in the field.

Taylor (2005, p.176) say that the rise of web improved recruitment process making it a revolutionary development, destined to change the way this process operates. Harvey and Blakely (2002, p.93) say that e-recruiting has had a profound effect on business in general; the scope and definition of e-recruiting is changing from extra-organizational process to an inter-organizational one. Bondarouk et al. (2011, p.160) say that online recruitment can be defined as the use of the Internet to attract potential employees to an organization (using the company's own corporate website and also the commercial jobs boards). Also, Falcone (2002, p.67) add that the Internet first emerged as a recruitment method in he mid-1990s and, since then, its use has risen considerably. Companies are changing their recruiting paradigms to sell to an incrdibly tightened job market; one way to sell themselves to the market is through Internet ads.

Organizations are using e-recruitment as a way of attracting candidates, becoming a challenging task due to the growing competition for talented employees. To find these employees the organizations cross even the local borders (Kavanagh et al., 2013, p.371).

The Internet has become a mainstream recruitment medium in recent years (Price, 2007, p.342). The Internet and the web have revolutioned the way people communicate, bringing a radical change on doing business and also creating models that did not exist in the past (Kamel, 2006, p.143). Internet technologies have introduced profound changes in many aspects of our lives; big changes have also occured in the way that people look for new jobs and how organizations recruit and select them for work (Reynolds and Weiner, p.XIII). Websites has become a new method to recruit future employees using e-mails and social networking sites into the new digital media recruitment (Toepel, 2015, p.75). Online job boards and company websites were seen as credible sources of employment (Landers and Schmidt, 2016, p.192). Online recruitment can be done using email, websites and social network sites (Fieldrig et al., 2016).

3. E-recruitment: benefits and dizadvantages

"It seems that the Internet and the Intranet were specially created for human resources management"- Doran A., 2001.

E-recruitment offers many benefits for the organization who use a platform to attract the talented future employees and for the candidates who use this platform in order to submit their resumes.

Benefits for organization and for the candidates:

- reduce time, costs for organizaton and also for the candidates (Bournois et al., 2007). Cappelli (2001) estimated that, the costs for e-recruitment are just 20% from the costs destinated for traditional recruitment;
- geographical spread (Cappelli, 2001; Pin et al., 2001; Freeman, 2002; Barber, 2006);
- larger audience (Bartram, 2006; Pin et al., 2001; Galanaki, 2002; Barber, 2006);

- greater chance to find right candidate; quicker/greater effectiveness (Galanaki, 2002; Barber, 2006);
- relatively cheap (Galanaki, 2002; Cappelli, 2001; Pin et al., 2001),
- higher quality of applicants (Bartram, 2000);
- better match workers/vacancies, reduction of unqualified candidates (Pin et al., 2001);
- improve corporate image and profile (IES Report, 402), reduce recruitment costs, reduce administrative burden, employ better tools for the recruitment team;
- the ability to target a wider and more diverse pool of candidates, more opportunities for smaller companies (Pin et al., 2001);
- quicker turn-around time/cost saving (Galanaki, 2002; Pin et al., 2001; Zusman and Landis, 2002; Cappelli, 2001; Florea, 2013, p.80);
- is the cheapest and the most effective wayof recruitment (Falcone, p.67), reducing the costs with 85% (Bach, 2005);
- 24/7, time saving and relatively cheap (Cappelli, 2001; Pin et al., 2001; Freeman, 2002; Barber, 2006; Doran, 2001);
- easy access to information about employer (Barber, 2006);
- reduce the costs with paperand printing (Doran, 2001);
- offer the opportunity to choose a large number of candidates of quality, at a lower cost (Armstrong, 2006);
- allows organizations to escape from the hassle of going through an enourmous number of CVs (Kamel, 2006, p.143);
- user-friendly, speed, effectiveness, price, imrpove branding (Van der Sluis and Van de Bunt-Kokhuis, 2009, p.205);
- speed of filling a job opening (Kavanagh et al., p.371), quality and dyversity of applicants;
- rapidity of the process, eliminate the intermediares (Hopkins, 2003);
- time-efficiency, relatively simple process, grow the productivity (Bournois et al., 2007);
- low costs, many qualified (Bondarouk, 2009), international accesibility (Galanaki, 2002);
- allows previewing the applications (Hopkins, 2003);
- a new vector in receiving the resumees (Guillot-Soulez, 2009);
- the ad get also to the passive candidates (Czerny, 2004);
- convert rapidly the text and extract the key-words (Armstrong, 2006);
- may have the ability to attract and retain the right candidates (Cohen, 2001);
- Provide inexpensive and efficient communication channels and identify passive job seekers (Harvey and Blakely, 2002, p.93);
- E-recruitment is a win-win situation both for organization and also for the candidate (Kavanagh et al., 2013, p.371);
- Low cost and broad reach (Posthumus, 2015, p.51);
- E-recruitment is knowing an extensive use (is efficient in finding the right candidate for large organizations and also for smaller onse) (Price, 2007, p.342);
- offer valuable and updated info for the candidates (Doran, 2001);
- modify the way of seaching by using spontainous resumees (Guillot-Soulez, 2009).

Dizadvantages

Besides the many advantages presented above, there are also some dizadvantages of e-recruitment, such as:

- the limited access of potential candidates due to some factors: age (this category being not prepared compared with the new „digital generation" (Bondarouk, 2009) , the level of knowing to use computer or use Internet, the low level of financial resources in order to buy a computer, these persons getting to the process named by the researchers „digital isolation" (Lancaster, 2003);
- the employers are receiving too much resumes for the vacancies implying higher costs (Torrington et al., 2005). Many ads may occur without being real;
- development fees for small companies (Barber, 2006);
- corporate name recognition required (Galanaki, 2002; Barber, 2006);
- outdated résumés (Hays, 1999);
- discrimination/privacy (Bartram, 2000; Feldman and Klaas, 2002); Pin et al., 2001);
- internet not the first option for applicants (Piotrowski and Armstrong, 2006; Brencic and Norris, 2008);
- overwhelming number of candidates (Cappelli, 2001; Barber; 2006);
- number of unqualified candidates (Galanaki, 2002);
- lack of personal touch (Feldman and Klaas, 2002; Brencic and Norris, 2008);
- privacy problems (Pin et al., 2001; Brencic and Norris, 2008);
- discrimination of those who do not have access (Pin et al., 2001; Barber, 2006).

4. Research - analyzing the influence of some factors on efficiency of e-recruitment on Romanian level

We made this research starting with the facts:

- The Internet has profoundly influenced many processes, including recruitment process;
- It has been an important rise in using e-recruitment in the recent years;
- Internet penetration rates is growing continuously;
- Internet offers many important benefits for organizations and also for the candidates;
- The online job market is growing faster than the conventional recruitment market.

Objective

The main objective of this article is to show the role of new technologies and of the Internet have in recruitment process and in implementing them in order to find talented future employees necessary to achieve competitive advantage. We want to show that there is a direct relationship between the Internet and recruitment process using simulation and modeling.

Research Hypotheses

For the purpose of this study, the following hypotheses were put to test and analyse them.

H1- There is a direct and positive relationship between e-recruitment and the analyzed variables.

H2- There is a normal distribution among the analysed variables.
H3- There is a correlation between the analyzed variables.
H4- There is a normal distribution for residuals.

Sample selection

Data were gathered from Romanian level on 11 years period, between 2006 and 2016.

Tools Used for Analysis

In this study we were using the following tools:

- Linear Regression Model (using OLS to test the impact of two dependent variables on the independent variables);
- Descriptive Statistics (to find out the normal distribution of returns of the analysed variables);
- Correlation Matrix (to find correlation between the analysed variables);
- Normal distribution of residuals (Skewness, Kurtosis, Jarque-Bera tests).

The computation of data for this study was made by using E-Views (Version 7.0).

Research Methodology

To remain competitive in today's global and continuously dynamic environment, organizations are looking for more efficient and effective means of attracting, obtaining and retaining talented employees. A mean which can help organizations to achieve their goals is to use and implement new technologies and especially the Internet.

In this article we used samples of nine variables registred at Romanian level (Table no. 1).

Table no. 1. The variables influencing e-recruitment

year	individuals using internet for looking for a job or sending a job application (e-recruitment	Internet penetration rate (%)	Internet use by individuals	individulas frequently using the Internet	individuals regularly using the Internet	individulas using the Internet for sending or receiving e-mails	individuals level of computer skills	individuals level of Internet skills (e-skills)	enterprises with broadband access
2006	3	24.7	21	9	18	16	13	14	31
2007	3	28.3	24	12	22	20	14	16	37
2008	3	32.4	29	15	26	24	16	19	44
2009	5	36.6	33	19	31	28	17	22	41
2010	7	39.9	36	21	34	31	16	25	52
2011	9	40	40	24	37	35	15	20	57
2012	9	45.9	46	29	43	38	14	24	62
2013	8	49.8	50	32	45	42	16	29	67
2014	8	54.1	54	32	48	43	18	30	82
2015	6	56.8	56	37	52	43	19	31	85
2016	7	58	60	42	56	42	20	32	80

Source: www.eurostat.com.

To understand better the difference/the gap between the analyzed variables we make a graphical representation of the trend of analyzed variables at European level (EU28) and Romania between 2006 and 2016 (Figure no. 1).

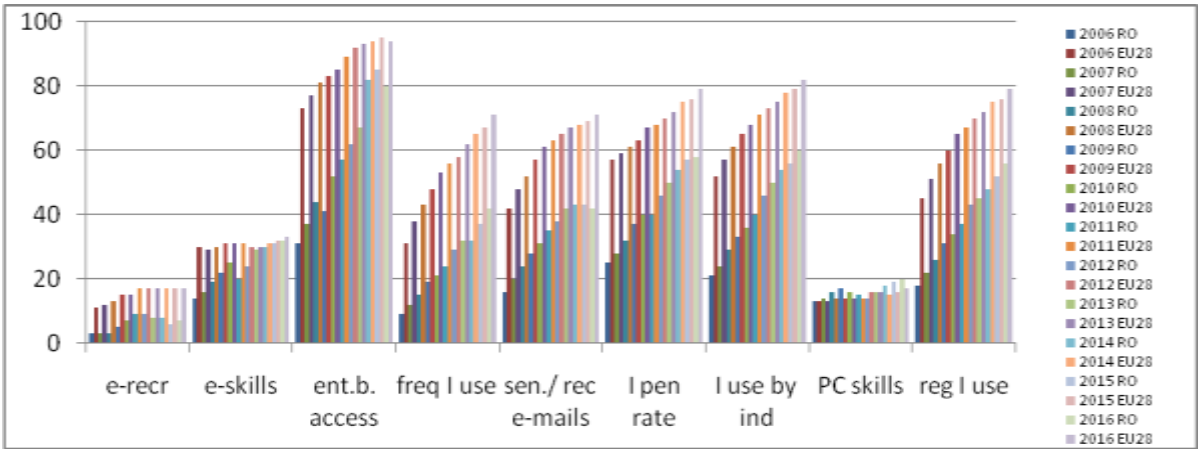

Figure no. 1. The reprezentation of analyzed variables EU28 vs Romania between 2006 - 2016

We may see that, the e-recruitment is almost 100% in many developed countries, and in Romania is still low. According to the data registred at European level, Romania ranks the last in DESI 2017 (connectivity, human capital, use of internet, integration of digital technology, digital public services) (https://ec.europa.eu/digital-single-market/en/scoreboard/romania). Romania is classified the second to broadband access and the speed of Internet but, the rate of digitisation of economy and the level o digital skills is very low (Figure no. 2).

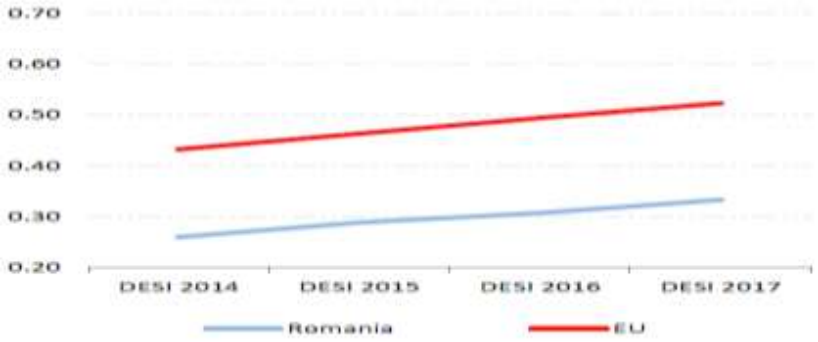

Figure no. 2 DESI evolution over time (EU and RO)

	Romania		Cluster	EU
	rank	score	score	score
DESI 2017	28	0.33	0.41	0.52
DESI 2016[1]	28	0.31	0.38	0.49

Figure no. 3. DESI 2017- relative performance

As we may observe, DESI is the lowest value for Romania registred for the last two years at European level (Figure no. 3). Even if the individuals use the internet from 21 to 60 from 2006 to 2016 (Table no. 1), according to eurostat.com, and digital skills are improving, Romania is remaining the second lowest from EU. Internet users engage in online activities much less than the EU average, in particular when it comes to e-commerce and e-banking.

5. Using OLS method

The coeficients of the analysed variables can be estimated by using the OLS method. Using Eviews 7 we may observe the relationship between e-recruitment and the analyzed variables (Figure no. 4).

Dependent Variable: E_RECR
Method: Least Squares
Date: 02/25/17 Time: 21:15
Sample: 1 11
Included observations: 10

Variable	Coefficient	Std. Error	t-Statistic	Prob.
E_SKILLS	0.624047	0.023323	26.75705	0.0238
ENTERPR_INT	-0.165202	0.005985	-27.60185	0.0231
FREQ_INT_INDIV	-1.125645	0.028819	-39.05895	0.0163
NDIV_SEND_RECEIV_EMAILS	-0.225187	0.016489	-13.65715	0.0465
INT_PEN_RATE	-0.256746	0.037449	-6.855882	0.0922
INT_USE_INDIV	0.452537	0.025700	17.60841	0.0361
PC_SKILLS_INDIV	-1.001891	0.021864	-45.82468	0.0139
REG_INT_INDIV	1.096921	0.033882	32.37518	0.0197
C	3.326496	0.249281	13.34438	0.0476

R-squared	0.999952	Mean dependent var	5.900000
Adjusted R-squared	0.999571	S.D. dependent var	2.282786
S.E. of regression	0.047287	Akaike info criterion	-3.767732
Sum squared resid	0.002236	Schwarz criterion	-3.495405
Log likelihood	27.83866	Hannan-Quinn criter.	-4.066474
F-statistic	2621.632	Durbin-Watson stat	3.561896
Prob(F-statistic)	0.015104		

Figure no. 4. OLS using e-recruitment as a dependent variable

Finishing the calculation using OLS method, we obtain the estimation equation, which has the following values (Figure no. 5):

Estimation Equation:
==========
E_RECR = C(1)*E_SKILLS + C(2)*ENTERPR_INT + C(3)*FREQ_INT_INDIV + C(4)*INDIV_SEND_RECEIV_EMAILS + C(5)*INT_PEN_RATE + C(6)*INT_USE_INDIV + C(7)
*PC_SKILLS_INDIV + C(8)*REG_INT_INDIV + C(9)

Substituted Coefficients:
==========
E_RECR = 0.624046592601*E_SKILLS - 0.165201817893*ENTERPR_INT - 1.12564498407*FREQ_INT_INDIV - 0.225187415117*INDIV_SEND_RECEIV_EMAILS -
0.256746102846*INT_PEN_RATE + 0.452537401949*INT_USE_INDIV - 1.00189146512*PC_SKILLS_INDIV + 1.09692096939*REG_INT_INDIV + 3.32649553915

Figure no. 5. The values for calculated variables

The regression model shows that the free term is positive (3.32) and an increase of 1 point in the e-recruitment will trigger an increase by 0.62 points of the e-skills, a decrease by – 0.16 points of enterp_int, a decrease by – 1.12 of the frequency, a decrease by – 0.22 of the sending/receiving e-mails, a decrease by – 0.25 of internet penetration rate, an increase by 0.45 of internet use, a decrease by – 1.00 of computer skills, and an increase of regularity by 1.09.

R-squared is 0.999, resulting that R is 0,99949, concluding that between e-recruitment and the analyzed variabls there is a strong, direct and positive relationships (being almost equal to 1). Thus, the hypothisis **H1- There is a relationship between e-recruitment and the other analyzed variables** is accepted.

Descriptive statistics

Table no. 2 presents a summary of the descriptive statistics using data between 2005-2016 at Romanian level.

Table no. 2 The results of descriptive statistics for analysed variables during 2006 and 2016

	E_RECR	E_SKILLS	ENTERPR_I...	FREQ_INT_I...	INDIV_SEN...	INT_PEN_R...	INT_USE_IN...	PC_SKILLS...	REG_INT_I...
Mean	6.181818	23.81818	58.00000	24.72727	32.90909	42.70000	40.81818	16.18182	37.45455
Median	7.000000	24.00000	57.00000	24.00000	35.00000	43.00000	40.00000	16.00000	37.00000
Maximum	9.000000	32.00000	85.00000	42.00000	43.00000	58.00000	60.00000	20.00000	56.00000
Minimum	3.000000	14.00000	31.00000	9.000000	16.00000	25.00000	21.00000	13.00000	18.00000
Std. Dev.	2.358736	6.193839	18.91560	10.60274	9.792390	12.08351	13.35528	2.182576	12.47689
Skewness	-0.322985	-0.133597	0.125987	0.064851	-0.460121	-0.118032	-0.044955	0.302128	-0.088494
Kurtosis	1.628797	1.727673	1.678469	1.873689	1.812402	1.592137	1.675489	2.117170	1.811058
Jarque-Bera	1.053009	0.774680	0.829553	0.589141	1.034565	0.849085	0.807773	0.524569	0.662250
Probability	0.590666	0.678860	0.660488	0.744851	0.596138	0.654069	0.667720	0.769292	0.718115
Sum	68.00000	262.0000	638.0000	272.0000	362.0000	427.0000	449.0000	178.0000	412.0000
Sum Sq. Dev.	55.63636	383.6364	3578.000	1124.182	958.9091	1314.100	1783.636	47.63636	1556.727
Observations	11	11	11	11	11	10	11	11	11

We may observe that in the summary statistics were used mean, minimum, maximum, median, standard deviation (SD), skewness, kurtosis and the Jarque- Bera in order to analyse the sample during the period noted above. All the analyzed variables present a positive mean value. The mean for enterprises with broadband acces has the largest value (58.0) but not so much comparing with the other analyzed variable (6.18 - the minimum, and 42.7 - the maximum). The range of variation between maximum and minimum is quite logical. We observe in the table above that for all data series, the mean and median have very similar values, the ratio between mean and the median of each variable being approximately 1.

The standard deviation compared to the mean is not low which indicates coefficient of variation. Also, the sum squared deviation row represents the net change over the sample period. It shows that internet use by enterprise and for individulas increased very much, while e-recruitment and computer skills increased insignificaly. Also, the standard deviation (Std. Dev.) of data series has small values for all the variables and therefore it can be considered that the series are relatively homogeneous.

In terms of skewness, the results for variable 1, 2, 5, 6, 7 and 9 are negatively skewed while for variable 3, 4 and 8 indicate a pozitive skewness.

The value for kurtosis in each variable is between 1.59 and 2.11 being below the benchmark for a normal distribution of 3, which is positioned near normality. It is important to show that all the values of kurtosis are smaller than three, but bigger than 0, making the distribution Leptokurtic and the values concentrated around the central tendency. Thus, the analyzed variables are characterized by a normal distribution.

The values obtained for Jarque Bera test are between 0.52 and 1.05 (indicating that all the variables are approximately normally distributed), having associated probabilities between 0.59 and 0.76 indicating that the variables are not volatile. The Jarque-Bera (JB) values show that all the sample indices were normally distributed. In other words, all the sample indices were less volatile during the analysed period. Thus, the distribution of all the sample indices was normal.

So, the hypothisis H2- **There is a normal distribution among the analysed variables**, was accepted.

6. The correlations among the analysed variables

In Table no. 2 we can observe if there is any relationship between two analyzed variables. According to the results, the values of correlation are all strong and pozitive and ranged from 0.35 to 0.99. Between frequency of using internet and: regularly using the internet there is the strongest relationship (0.99) and internet use by individuals (0.99), and

than between the internet penetration rate and: e-skills (0.98) and frequency of using internet (0.98), sending e-mails and e-skills (0.97), internet use by individuals and e-skills (0.97) and so on.

The following calculations shows the correlations among the analyzed variables.

Table no. 2. The correlation matrix

Correlation									
	E_RECR	E_SKIILS	ENTERPR_I...	FREQ_INT_I...	INDIV_SEN...	INT_PEN_R...	INT_USE_IN...	PC_SKILLS...	REG_INT_I...
E_RECR	1.000000	0.778353	0.725375	0.765820	0.858957	0.784269	0.788124	0.350551	0.790200
E_SKIILS	0.778353	1.000000	0.950398	0.963779	0.970244	0.983558	0.972375	0.832705	0.973006
ENTERPR_I...	0.725375	0.950398	1.000000	0.955832	0.955041	0.978902	0.976944	0.774984	0.968196
FREQ_INT_I...	0.765820	0.963779	0.955832	1.000000	0.960414	0.988707	0.993240	0.784739	0.996632
INDIV_SEN...	0.858957	0.970244	0.955041	0.960414	1.000000	0.980688	0.978111	0.709982	0.974456
INT_PEN_R...	0.784269	0.983558	0.978902	0.988707	0.980688	1.000000	0.996762	0.799984	0.996033
INT_USE_IN...	0.788124	0.972375	0.976944	0.993240	0.978111	0.996762	1.000000	0.778888	0.997384
PC_SKILLS...	0.350551	0.832705	0.774984	0.784739	0.709982	0.799984	0.778888	1.000000	0.785827
REG_INT_I...	0.790200	0.973006	0.968196	0.996632	0.974456	0.996033	0.997384	0.785827	1.000000

From these calculations results that the hypothesis **H3 - There is a corelation between the analyzed variables,** was accepted, thus between the analyzed variables do exist only direct, strong and positive correlations.

7. The normality for residuals

To test the residuals of the model, we have to analyze if they follow a normal distribution or not.

To verify the hypothisis of normality for residuals, we calculate the Jarque-Bera test, the skewness, which measure the symetry of the residulas distribution around the mean of these (and is zero), and the kurtosis. The Jarque-Berra test (JB) is based on the hypothisis that the normal distribution has the skewness, $S = 0$, and the kurtosis, $K = 3$.

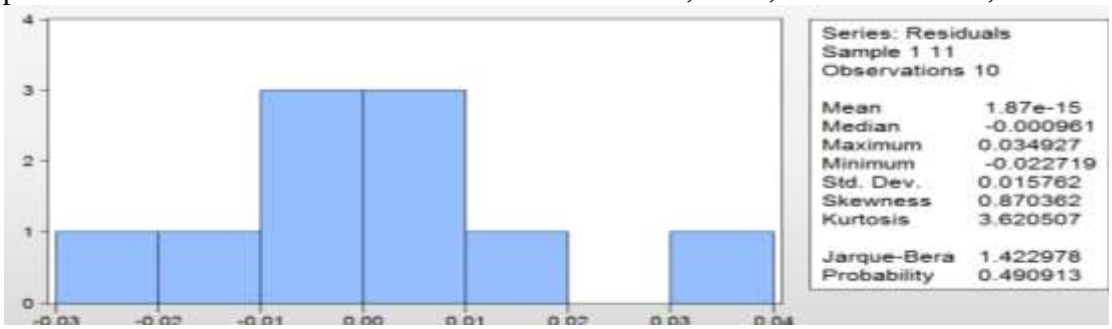

Figure no. 7. The distribution of residuals

If the probability p of JB is enough low, then the normality hypothisis of residuals is rejected, and if the probability is high, the normality of residuals distribution is accepted. In our case (Figure no. 7) the value of JB test is 1.42. It is observed that skewness = 0.87, and kurtosis =3.62, the probability of the test is =0.49. From these reasons we accept the hypothisis that the distribution of residuals follows a normal distribution. Thus, the hypothisis **H4 - There is a normal distribution for residuals** is accepted. This is observed also from the representation made by Eviews, which shows that the distribution of residuals is almost normal.

8. Conclusions

It was found that companies can increase the efficiency of the recruitment process if they integrate an e-recruitment system in their human resources management infrastructure that automates the candidate pre-screening process.

We may see that there are many important advantages of using e-recruitment such as efficiency at low costs and with big rapidity, and it can offer the opportunity of equal

chances for all the employees based on non-discrimination, equity, social responsibility and sustainable development, opportunity to find quickly talented employees, to screenout the employee marketplace, access many programs Internet-based for recruitment, to develop a data base using information about interested candidates and their skills, abilities, behavior, training programs, experience, to attract the talented employees, to lower costs of recruitment process, to attract the best employees by their brand, culture and internal values, to improve the relationships with future employees, having strategic impact on the direction of the organization and creating challenges for the business.

The results of using simulation and modeling techniques identify few important factors which may influence the technology adoption.

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