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The Employment Effect of ICTs in the Organization of Islamic Conference

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ABSTRACT

Information and Communication Technology (ICT), includes a wide range of hardware, software and supportive knowledge that has transformed human society from the information technology age to the knowledge age and dramatically substituted the traditional jobs with newly offered ones. So, the main question that remains to be answered is, whether it could have a positive effect on the level of employment. The present study provides an overview on the effective ways that ICTs help to create more employment opportunities across the selected Organization of Islamic Conference (OIC) economies. For this purpose, an econometric panel data model is run to analyze the relationship between ICT and employment rate of OIC countries for the period 2000 to 2009; using the Constant Elasticity Substitution (CES) category of production function. The results revealed that the introduction of technology has led to major structural changes in the economy of OIC member countries and there is also a positive and significant effect of the ICTs on employment rate but the effects are diversified among oil-based as well as non-oil economies.

Key words: Employment, ICT, information and communication, OIC

INTRODUCTION

In recent decades the discussion of outfit and proper distribution of resources in economic sectors of the society is considered as one of the most important issues. That is especially in the case of human resources' manipulation and its importance from quality and quantity aspects of view. In this regard developing countries that are traditionally characterized with lack of the requisite non-human resources to stimulate rapid and sustainable development, to be producing far below their full potentials, culminating in high rates of unemployment and underemployment with low wages (Adenutsi, 2010). Particularly, in the process of economic development, optimal using of physical and mental labor force plays a vital role, setting a superior goal for the planners in order to increase the rate of effective employment in the country. On the other hand the issue of globalization and information technology development is now defined as an inseparable part of development, following rapid changes occurred in developed as well as developing countries with respect to information and technology equipments. The economists believe that during the last two decades, new technological paradigms based on information and communication technology (ICT), especially economical application of internet, could bring about a positive change in the field of creating employment opportunities and promoting labor force markets (Barnes, 2007). Now a days the need for the development of ICT is a global resolution and has been a subject of great significance to all

mankind (Olaofe, 2005). These technologies have become central to contemporary societies. Whether one is talking on phone, sending an email, going to the bank, using a library, listening to sports coverage on the radio, watching the news on television, working in an office or in the field, going to the doctor, driving a car or catching a plane, one is using ICTs (Onasanya *et al.*, 2010).

Technology is usually considered as any sort of knowledge, creativity, invention, machinery and equipment which is used to promote human community life. On the other hand, Information Technology (IT) is defined as a set of hardware, software and thought ware which is used in the process of better sources utilization? According to the Information Technology Association of America (ITAA), IT is a combination of soft ware industry, office machines, data processing equipments and other communication hardware and software facilities. Furthermore, the nations use Information and Communication Technology (ICT) as any kind of communicational or programming device such as radio, television, cellular phone and computer or satellite net systems, in order to gain necessary information. In this regard, the World Information Technology and Services Alliance (WITSA), defines ICT as communicational equipment and software services required to study, plan, support and manage information systems based on computer soft- as well as hard- wares. Information and communication technology is also defined as a shorthand for the computers, software, networks, satellite links and related systems that allow people to access, analyze, create, exchange and use data, information and knowledge in ways that were almost imaginable (Association of African Universities, 2000). The prevalence and rapid development of ICTs has transformed human society from the information technology age to the knowledge age (Galbreath, 2000).

Among the member countries of Organization of Islamic Conference (OIC), there are countries with basic potentials suitable for huge investment in human capital resource through introducing more and more information and communication technology equipments. Programmers believe that the introduction of technology has led to major structural changes in the economy of OIC member countries. These changes have had an impact on productivity, labor markets, movement of workers across the borders and all kinds of the skills that workers need in an optimal level. The main objective of the study is to investigate the effect of ICT on employment rate of selected OIC member countries and also make a comparative study between the two distinguished groups of oil-based and non-oil-based OIC countries.

LITERATURE REVIEW

The impact of ICT on economic growth could be considered from both demand and supply overview. On the demand side, the growth of ICT and its equipments leads to more nationally and internationally demand of the societies for producing new relevant commodities and services. Economies of the world have become increasingly interdependent and concerted efforts by nations at establishing both bilateral trade links and subsequent formation of regional trading blocs are the upshot of this widely held view on the gains from trade (Hadiwibowo, 2010). On the supply side, it eventually increases the quantity of products by enhancing its productivity level. For many developing countries ICT equipments could provide job opportunities for the majority of migrants, who move to the cities and would like to have a certain level of education to be able to compete with the urban residents for these jobs (Molaei *et al.*, 2008).Therefore, taking into account the important place of ICT, a production function of a firm which is affected by utilizing factors, such as Labor Force, communication and technology and some other physical investments, could be formed as it is shown in the following Eq. 1:

$$Y_t = A_t f (C_t, L_t, K_t) \qquad\qquad (1)$$

where, Y_t is the added value affected by the Labor Force (L_t), physical investment (K_t) and information and communicational technology (C_t) through direct introducing of machinery services and indirect introducing of knowledge based technological changes (A_t) in the process of production. To follow the above mentioned approach it is urged that ICT can facilitate production, distribution and selling procedures in the market and finally affect the employment level of skillful Labor force in any country. Vivarelli (2007) expressed the effective ways of ICT on employment rate as increase in the number of skilled Labor force, decrease in production cost, development of competitive market, developing business atmosphere and finally motivation of self entrepreneurship, innovation and creativity. According to Freeman and Soete (1994), Vivarelli and Pianta (2000) and Edquist *et al.* (2001), innovation in production has positive influence upon employment. On the other hand, some researchers do not consider predictable the effect of ICT on employment Specifically, Koellinger (2006) believed that the effect of ICT on employment on one hand can be positive by making creativity result in employment and development growth and on the other hand can be negative due to replacement of machinery services instead of human labor force (especially non-skillful workers). Entorf *et al.* (1999) used a multi functional Logistic model to analyze the effect of technology on the employment of economic firms in France. The researchers used different equipments, such as robot, video, fax, as indicators of technology. Results of the study showed that, though utilizing technology in the form of computer and computer increases unemployment rate in short term, but it did not have negative effects on employment rate in long term, since the chain effects of technology on producing and investing are so vast that technology can further create some complementary jobs in long term. Besides, Diaz and Tomas (2002) studied the effect of technological innovation on the quality and quantity of employment in Spain for the period of 1980-1990. The results showed that technological innovations led to an increase in the number of technicians in 1990 compared to the same number in 1980. Matteucci and Sterlacchini (2003) showed the positive relation between rate of investment on ICT and increasing rate of employing at the end of 1990s. They have also compared the employment performance programs in USA, EU and Italy together using a comprehensive equation of 173 industries in order to estimate and explain employment growth model based on ICT influences. They concluded that, the recent development in US with respect to employment and productivity level of labor force was in a close relationship with ICT investment rate. Lal (2004) also studied the growth rate of employment and creating electronic business jobs in large scale industries of Nederland during 1995-2003. The results showed that by entering new technologies it does not necessarily indicated abolishing the existing jobs. On the contrary, by entering ICT and some relevant technologies to the market, required number of employment for skilled labor force was indirectly increased. A good work in this regard belongs to Harrison *et al.* (2008), in which they have investigated the effect of ICT on employment rate of France, Germany, Spain and England firms during the years 1998-2000 and concluded that, ICT not only created a direct and positive change in employing labor force but also created an indirect positive change, following compensatory effects of lowering the prices of the produced commodities. The effect of technology on employment has also been studied by Lachenmaier and Rottmann (2011) who observed a positive effect of technology in a firm level analysis. They stated that innovation in production process led to the production of new items in the market and consequently increased the labor force employment. In a similar study, Merikull (2008) also studied the effect of innovation

on employing rate of firms at industry level in Estonia for the period of 1994-2005. By applying labor force demand function of Reenen at firm level and Greenan and Guellec (2000) demand function at industry level, the research aimed to estimate the rate of employment creation in Estonia. Finally, they denoted that, ICT has positive effect on employing rate in both firm and industry Level. O'Mahony *et al.* (2008) made an investigation about the effect of ICT on skilled labor force demand in USA, England and France; using panel data and compared the countries one by one. The study results showed that, both employing rate and skilled labor force wages increased by entering ICT in service and production field of activities during the period of study. There was also a significant and meaningful difference among the countries with respect to the relationship between information technology and employing rate. As data reveals, US gained more benefit from ICT with respect to the employment rate than other investigated countries.

MATERIALS AND METHODS

The integration of theoretical studies and empirical research has caused research on growth to be a permanent and ongoing phenomenon (Zarra-Nezhad and Hosainpour, 2011). The model used in this empirical research is derived from Matteucci and Sterlachini (2003) model of study and assumes constant elasticity substitution function of production (CES) for this purpose. The general form of adopted CES production function along with two variables of labor force (L) and investment (K) is considered as in Eq. 2:

$$Q = A[(\alpha L)^{-\rho} + (\beta K)^{-\rho}]^{\frac{1}{\rho}} \tag{2}$$

where, Q indicates for production; L, labor force; K, capital investment; parameter A, technological alterations; α and β constants for measuring labor force and capital investment reactions to technological shocks and $\sigma = 1/(1-\rho)$ indicates the substitution elasticity of labor force and capital investment where the parameter ρ varies between 0 and 1. In order to maximize the profit of the firm and taking into account W, as expenditures for labor force; P, price of the product, the following logarithmic labor force demand function is produced Eq. 3:

$$\log L = \log Q - \sigma \log\left(\frac{w}{p}\right) + (\sigma - 1)\log A \tag{3}$$

Further, since in perfect competitive market and assuming constant return to scale it is possible to replace factors of production ratio L and K with the ratio of their prices (W, P) and also substituting Y and ICT instead of Q and A, so the Eq. 3 could be transformed into Eq. 4:

$$L = L\left(\frac{K}{L}, Y, ICT\right) \tag{4}$$

From one hand interdependence of L to K/L is basically accepted by the theories i.e. the rate of employing is quite affected by per capita investment and on the other hand, the impact of ICT on labor force quality is quite justified on the basis of the accumulated literature review. Therefore, the research could finally be constructed on the following Eq. 5:

$$\log(L)_{it} = \alpha_0 + \alpha_1 \log(\frac{K}{L})_{it} + \alpha_2 \log(Y)_{it} + \alpha_3 \log(ICT)_{it} + \mu_{it} \tag{5}$$

where, L indicates employing level; K/L, per capita investment; Y, domestic gross product, ICT; information and communicational technology expenditures; α_1, α_2 and α_3 show the employment elasticity coefficients to per capita investment, GDP and ICT expenditures, respectively. Index i indicates cross sections and index t indicates the time series in the panel data model of analysis. The estimated equation and the successive analysis of data being collected from OIC member countries was achieved by the selection of seven oil based countries including Iran, Saudi Arabia, Algeria, U.A.E., Kuwait, Egypt, Indonesia and nine non-oil countries including Cameron, Pakistan, Senegal, Tunisia, Turkey, Malaysia, Bangladesh, Morocco and Jordan. Most of the relevant data is gathered from the statistics of World Bank (2010) informative data base system during the period 2000-2009.

RESULTS

Since relevant data were not available in the case of many countries, unbalanced method of panel data analysis is used to estimate the model (5). First of all, it was necessary to determine proper selection between pooling and panel method through testing the hypothesis that cross sectors are either homogeneous or heterogeneous. For this purpose, the null hypothesis is based on assuming homogeneous sectors (Pooling Data Method). The statistics (Limer F test) showed that the null hypothesis is rejected and alternative hypothesis based on using panel data method could be accepted (Table 1). The next step was to get decision on using sectoral fixed or random effects in panel data method. In order to determine the effect, Housman F test is used and the results are illustrated in Table 1. Statistic (t) of the test output show that presence of fixed effects is accepted and up to 95 percent meaningful. Further, Wald chi-square test is run to reject the null hypothesis based on presence of heterogeneous variance between the groups. As it is shown in Table 1, χ^2 statistics rejects the null hypothesis and therefore general least square (GLS) method is further used to assess the model.

The results of model estimation (Eq. 5), using panel data with fixed effects and applying General Least Square (GLS) method for selected OIC member countries are extracted in Table 2.

Table 1: Limner F test, Housman F test and Wald χ^2 test for OIC members

Tests	Selected OIC	Oil-based countries	Non-oil based countries
Limner F	373	82/403	75/307
Housman F	393	86/190	41/188
Wald χ^2	406.52	17/52	17/672
Test output status	Panel data with fixed effects	Panel data with fixed effects	Panel data with fixed effects

Table 2: General least square assessment for OIC members

Variable	(1)	(2)	(3)
LGDP	0/2***	0/26***	0/22***
	(40/05)	(15.27)	(11/5)
LKL	-	-0/07***	-0/09***
		(-4/11)	(-5/31)
LICT	-	-	0/045***
			(7/37)
Countries	16	16	16
Observations	156	150	148
R²			0/99

(*), (**), (***) indicate 10, 5 and 1 percent significant levels for test. Values in brackets indicate t-statistics values

Table 3: Comparative assessment for two groups of OIC members

Variable	Oil-based countries			Non-oil-based countries		
	(1)	(2)	(3)	(1)	(2)	(3)
LGDP	0/22***	0/24***	0/22***	0/18***	0/33***	0/19***
	(13/76)	(10/68)	(10/68)	(17/83)	(8/29)	(5/42)
LKL	-	-0/044**	-0/04*	-	-0/15***	-0/1***
		(-2/39)	(-1/872)		(-4/14)	(-3/62)
LICT	-	-	0/018**	-	-	0/06***
			(2/18)			(7/53)
Countries	9	9	9	7	7	7
Observations	90	88	88	66	62	60
R²	-	-	0/99	-	-	0/99

(*), (**), (***) indicate 10, 5 and 1 percent significant levels for test. Values in brackets indicate t-statistics values
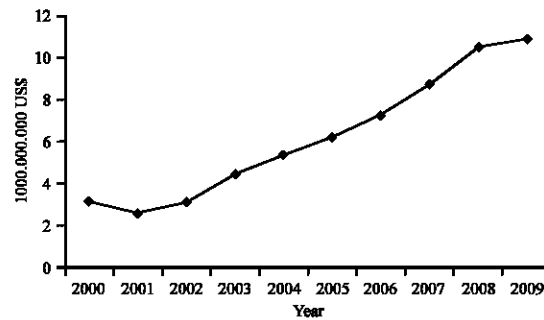

Fig. 1: ICT average cost trend in OIC countries (2000-2009), Source: World Bank, 2010

That is found that during the period 2000-2009, the coefficient value for ICT variable was positive (0.045) and 99% meaningful. It means for each 1 percent increase in ICT expenditures, employing rate will increase as high as 0.045%. The coefficient value of Gross Domestic Product (GDP) is also positive (0.2) and 99% meaningful. It means for each 1% increase in GDP, employing rate will increase as high as 0.2%. Contrarily, the results showed that the per capita investment increase has a negative effect on employing rate. The coefficient value for elasticity of employment towards per capita investment is -0.08 (Table 2) meaning that for each 1% increase in per capita investment, employing rate will decrease as low as 0.08% which is compatible with the results of those studies that in short run term any attempt to enhance the capital-labor ratio exerts negative effect on the employment level.

To assess and evaluate the comparative effects of ICT on employing rate, selected countries are further divided into two groups of oil-based and non-oil-based countries. As it is shown in second column of Table 3, the effect of ICT expenditures on employing rate of both groups are positive and significant but the intensity of effectiveness is lower in the case of non-oil-based economies. Average cost trends in OLC countries (2000-2009) is shown in Fig. 1.

CONCLUSIONS

From the second half of 21st century onwards, with the emerging of computers and internet to the ICT products market, a great revolution has been occurred in the information and communication field of economic activities. During the recent two decades growth of ICT and its

function in different socio economic activities of the society led to emergence of a new approach among the people, organizations, companies and governments to change their classical and traditional thoughts of business life for a better standard of living. For many countries, such as organization of Islamic conference members, growth of ICT expenditures compounded an important leading part in gross domestic product of the country with positive ascending trend line during the period 2000-2009 as it is shown in Fig. 1.

In this study, the effect of ICT on employing rate in selective Organization of Islamic Conference countries has been investigated during the years 2000-2009. Logarithmic results show that ICT investment has a positive and significant effect on both oil-based and non-oil-based countries employing rate during the period of the study. While the intensity of effectiveness is lower in the case of non-oil-based economies. It is obvious that ICTs have contributed to the automation of processes, making some workers redundant and closing off jobs and even some handmade and traditional jobs are being abolished and replaced by administrative jobs in short run. In parallel, at the same time ICTs have changed the economics of many sectors by reducing the importance of scale, so facilitating an upsurge in employment in small and medium enterprises. These sorts of jobs have flexibility enough to utilize modern technologies; they may have positive effects on employment rate of skilled and semi-skilled Labor force in the long run. The results of this study during the years 2000-2009 denoted that for selected OIC member countries, one percent increase in ICT expenditures and GDP of the country leads to employing rate increase as high as 0.045 and 0.2%, respectively. But in the case of per capita investment, it shows a negative effect on employing rate (-0.08). Therefore, it is recommended for OIC member countries to find out those areas of technology which have particular importance to domestic product industries and the country has particular strength or possible areas for future competitiveness.

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REFERENCES

Adenutsi, D.E., 2010. Do international remittances promote human development in poor countries? Empirical evidence from Sub-Saharan Africa. Int. J. Applied Econ. Finance, 4: 31-45.

Association of African Universities, 2000. Technical experts meeting on the use and application of information and communication technologies in higher education institutions in Africa. May 17-19, University of Dar-es-Salam, Tanzania.

Barnes, S., 2007. E-Commerce and V-Business: Digital Enterprise in the Twenty-First Century. Butterworth-Heinemann, London, ISBN: 9780750664936, pp: 4.

Diaz, M.S. and F.J.Q. Tomas, 2002. Technological innovation and employment: Data from a decade in Spain. Int. J. Prod. Econ., 75: 245-256.

Edquist, C., L. Hommen and M.D. McKelvey, 2001. Innovation and Employment: Process Versus Product Innovation. Edward Elgar Publishing Ltd., UK., ISBN-13: 978-1840644142, Pages: 224.

Entorf, H., M. Gollac and F. Kramarz, 1999. New technologies, wages and worker selection. J. Labor Econ., 17: 464-491.

Freeman, C. and L. Soete, 1994. Work for All or Mass Unemployment?: Computerised Technical Change into the Twenty-First Century. Pinter Publishers, London, ISBN: 9781855672567, pp: 193.

Galbreath, J., 2000. Knowledge management technology in education: An overview. Educ. Technol., 9: 28-33.

Greenan, N. and D. Guellec, 2000. Technological innovation and employment reallocation. Labour, 14: 547-590.

Hadiwibowo, Y., 2010. Capital inflows and investment in developing countries: The case of Indonesia. Int. J. Applied Econ. Finance, 4: 220-229.

Harrison, R., J. Jaumandreu, J. Mairesse and B. Peters, 2008. Does innovation stimulate employment? A firm-level analysis using comparable micro-data from four European countries. NBER Working Paper No. 14216, http://www.eco.uc3m.es/temp/emplcis.pdf

Koellinger, P., 2006. Impact of ICT on corporate performance, productivity and employment dynamics. Special Report No. 01/2006, European Commission, DG Enterprise and Industry, http://www.empirica.com/themen/ebusiness/documents/TR_2006_ICT-Impact_I.pdf

Lachenmaier, S. and H. Rottmann, 2011. Effects of innovation on employment: A dynamic panel analysis. Int. J. Ind. Org., 29: 210-220.

Lal, K., 2004. Growth of employment and the adoption of E-business. Discussion Paper Series, United Nations University.

Matteucci, N. and A. Sterlacchini, 2003. Information and communication technology and employment growth in Italian industries. http://dea2.univpm.it/quaderni/pdf/193.pdf

Merikull, J., 2008. The impact of innovation on employment: Firm-and industry-level evidence from Estonia. Working Papers of Eesti Pank No 1/2008, http://www.eestipank.info/pub/en/dokumendid/publikatsioonid/seeriad/uuringud/_2008/_1_2008/_wp_108.pdf

Molaei, M.A., A.S. Santhapparaj and C.A. Malarvizhi, 2008. Rural migrant's job preference in urban Iran and its determinantes. The Int. J. Applied Econ. Finance, 2: 36-43.

O'Mahony, M., C. Robinson and M. Vecchi, 2008. The impact of ICT on the demand for skilled labour: A cross-country comparison. Labour Econ., 15: 1435-1450.

Olaofe, I.A., 2005. Nigerian educational emancipation: Roadmap from crisis to resurgence. Faculty of Education Seminar Series, No. 1. Ahmadu Bello University, Zaria.

Onasanya, S.A., R.A. Shehu, R.O. Oduwaiye and L.A. Shehu, 2010. Higher institutions lecturers attitude towards integration of ICT into teaching and research in Nigeria. Res. J. Inform. Technol., 2: 1-10.

Vivarelli, M. and M. Pianta, 2000. The Employment Impact of Innovation: Evidence and Policy. Routledge, London, Pages: 240.

Vivarelli, M., 2007. Innovation and employment: A survey. IZA DP No. 2621, Institute for the Study of Labor, Italy, pp: 2-4. http://ftp.iza.org/dp2621.pdf

World Bank, 2010. World development indicator. http://data.worldbank.org/news/world-development-indicators-2010-released

Zarra-Nezhad, M. and F. Hosainpour, 2011. Review of growth models in less developed countries. Int. J. Applied Econ. Finance, 5: 1-17.