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Research Article

A REVIEW OF ECONOMIC AND LEGAL EFFECTS OF INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) ON THE VALUE ADDED OF IRAN'S MAJOR INDUSTRIES RELYING ON ICT ACTIVITIES AND THE RELATED LAW

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ABSTRACT
In this study, the impact of ICT on the value added of Iran's industry sector is taken into account during the period 1999–2010. To this end, the production function "Cobb Douglas" is applied in which production function of variables of the employed, and ICT as well as non-ICT capital stock are considered. To estimate the target, a panel data model and fixed effects are used. The obtained results indicate that in addition to manpower and non-ICT capital stock, the ICT capital stock has also a positive and significant effect on the value added of the country's industry. In order to confirm a target hypothesis, executive recommendations like the creation of appropriate infrastructure to make greater use of ICT and appropriate legislation, supervision and support from the government are emphasized.

Keywords: *The Value Added of Industry Sector, Panel Data, Economic Growth, Information and Communication Technology (ICT), Industrial Sites with 50 Workers and More*

INTRODUCTION
Half of the twentieth century onward, with the arrival of computers in market and evolution in the field of communication and information technology, computers also joined communicative technologies; then, information and communication technology revolution occurred, and the use of the effect of this technology on components of the economy became an important issue. Throughout the world, information technology is evolving new that its importance is not less than the industrial revolution; its application in various areas has become a mutant factor, and the experience of advanced countries shows the issue.

In general, the ultimate goal of each economy is to increase the individuals' welfare of society through sustainable growth and development which this important issue in the current global environment, regardless of industry and industrialization is impossible. Many believe that by improving industrial performance as the engine of economic growth can achieve higher welfare. Recently, a growing interest has occurred in knowledge participation in the growth of total productivity (technical progress) and consequently, in long-term development and sustainable economic development. Existing evidence in developed countries indicated that the arrival of ICT in the industry of country could lead to industrial growth and, ultimately, economic growth. Due to the direct connection between the growth of the value added of the industry sector on economic growth, this study manages to examine the impact of ICT on the value added of Iran's industry sector in the period 1999-2012.

In order to study the relationship between mentioned variables, first, theoretical foundations and economic growth literature as well as information and communication technology are taken into account; then, it is paid to stipulate pattern, explain the variables and estimate the pattern for selected industries and finally, according to results of the estimation, the research hypothesis based on the effect of ICT on the value added of the industry sector is tested and reviewed.

Theoretical Foundations of Growth Patterns Relying on ICT:
Information and communication technology plays a role on the supply and demand side of the economy, affecting through consumer desirability function on the demand side and through manufacturer's behavior on the supply side of the economy.

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In this research, according to the purpose of the studied subject, the effect of ICT on the supply side of the economy is reviewed.

Information and communication technology is entered as an input on the supply side of the economy, along with other inputs in the form of capital and improves the production process through capital deepening, technology advancement and work force quality. The value added output is at three levels of enterprise, sector and country and ultimately provides economic growth, industrial growth, productivity growth of the work force, profitability, and the increase of welfare levels.

In recent years, presenting endogenous growth patterns, economists tried to explain new knowledge and technology as a new input of endogenous growth factor. In this regard, the separation of human capital from technology as the encoded or visualized knowledge is considered as one of the important topics that makes the information and communication technology be discussed as an important endogenous growth factor.

Economic growth function is estimated using ICT to economic literature with procedures, including production function estimation, growth accounting and applied growth models.

We begin with the production function method assuming the production function is in the form of the Cobb Douglas:

$$Y=A.C^{a_c}.k^{a_k}.H^{a_h}.L^{a_n}$$

Here, for simplicity, time symbol is not considered in the pattern. By taking natural logarithm, the production function will be in the natural, linear and following form:

$$LnY=LnA+a_cLnC+a_kLnk+a_hLnH+a_nLnL$$

Assuming the existence of information on the above variables, parameters can be estimated. This function can be estimated for time series analyses of a country and cross-country analyses of a group of countries. To estimate the economic growth, we derive from the above equation to time:

$$\hat{Y}=\hat{A}+a_c.\hat{c}+a_k\hat{k}+a_h.\hat{H}+a_n.\hat{L}$$

Where $\hat{}$ indicates the rate of changes.

If the assumption of constant returns is considered to the production scale and also all factors are paid attention the same as the final production, the a coefficients will express the share of factors in total income. In this case, growth accounting technique can be used directly to determine the participation rate of production factors in the economic growth. Given that all factors other than technology changes $\hat{A}$, are visible in the above equation; the remaining changes are achieved called as the rate of total or multifactor productivity.

Dramatic advancements in the field of ICT in the 1990′s that are combined with the rapid improvements in the quality of ICT goods and equipment have a great impact on the economic growth of countries of the world. On the one hand, the production of ICT goods and services helps the economic growth, and on the other hand, innovation in the ICT sector gives rise to technology advancement. Therefore, ICT is the embodiment and manifestation of the technology advancements in the present age, and with the development of growth patterns, ICT as a describing factor of the economic growth enters into the production function.

Research Background:

An Overview of Foreign Studies:

In this section, first, we consider the research that in terms of research methodology is similar to the approach taken in this research methodology, and then, we examine other research related to the subject.

Evidence indicates the industrial growth in ICT-producing industries and services has accelerated in the United States of America and European industrialized countries. The separation of the industrial growth of ICT among European industries indicates an accelerating growth in the ICT-producing industries.

The results of production function estimation show that ICT investment imports and expenses of the last year are statistically positive significant variables. The results of estimation of efficiency of the work force also show that domestic ICT investment imports and expenses are positive significant variables. In addition, the results also suggest that in both estimated equations, variable coefficient of imports is not greater than ICT significant variable coefficient.

The effect of information and communication technology revolution will appear generally in three stages: At first, technology change increases the productivity growth in the manufacturing sector of innovation. Second, reducing prices increase capital deepening, and third, production reorganization can occur about capital goods that a new technology is hidden within them. So, it is expected that the benefits of ICT would increase in Asia and the world in the future. In addition, innovations done in the past are considered as a very important complementary element that causes more useful and beneficial investment in ICT. In this study, using combined data and GMM techniques to estimate the Cobb Douglas production function for the service sector, production traction to ICT capital is calculated 7/5% reflecting the effect of ICT on the service sector.

In their studies in more than 36 countries, Dewan (2001) and Pohjola (2001) reached this conclusion that wealthy industrial countries have a high, positive and significant relationship between information technology, growth and productivity, but no evidence showing such a relationship in developing countries is available. They assumed that this gap is due to low levels of investment in information technology in developing countries and lack of complementary assets, such as the knowledge-base structure to expand the use of information technology goods.

An overview of internal studies:

In the field of internal studies, the following items can be pointed:

Shojaei and Beigi (2010) considered the effect of ICT on Iran's economic growth using endogenous growth models from 1974 to 2007 and estimated the model using the panel data technique. Results of the research indicate that the ICT capital due to its small and insignificant share in comparison to total capital of the country has no significant effect on the economic growth and the country's gross domestic product.

Rasoulinejad and Noori (2009) considered the effect of information and communication technology on employment in Iran. The studied model with a vector error correction method (VECM) was estimated for Iran during the years 1956-2006. The results indicate that information and communication technology has a negative effect on employment in the short term, but the effect is positive in the long term. In addition, the impact of information and communication technology on the skilled work force in Iran is positive in the long-term and negative on the unskilled work force.

MATERIALS AND METHODS

In this study, the impact of information and communication technology on the value added of the country's industry sector is measured in the period 1999-2010.

It should be noted that the concept of the country's major industries is considered as the industries with 50 workers and more.

Dependent variable in this model of value added of industrial activities with 50 workers more is based on million Rials and in terms of ISIC classification. In this research, industries with two-digit ISIC codes are used.

Since statistics and information of the ICT variable are not available in the country in the reviewed time period, alternative statistics can be used to this variable. In this study, information and communication technology, and the cost of research and laboratory in terms of million Rials related to industrial activities with 50 workers and more are defined in accordance to the ISIC classification.

Another variable affecting the reviewed dependent variable in the present study is the workforce that in this study, the proportion of the workforce with university education to the entire employees of industrial activities with 50 workers and more is based on the ISIC classification.
Another capital variable in non-ICT sector in terms of million Rials related to industrial activities with 50 workers and more is based on the ISIC classification.
One of the applied methods to get the capital stock is acceleration principle which is used in this research in order to calculate the capital stock in the ICT and non-ICT sector.
In the present study, with the help of Matthews's as well as Stu Lachini's model and the use of the combined data, it has been tried the main issue in the study is tested. According to the acceleration principle, it is assumed that the ratio of current optimal capital to production is fixed in each industry, and the following relationship is established:

$$\alpha = \frac{K_t^*}{Y_t}$$

$$K_t^* = \alpha Y_t$$

And for the previous period:

$$K_{t-1}^* = \alpha Y_{t-1}$$

Net investment at the current time (I_{nt}) is equal to the difference between real capital stock of the previous period (K_{t-1}) and the current optimal capital stock (K_t^*):

$$\Delta K_t = \alpha \Delta Y_t \rightarrow \frac{\Delta K_t}{\Delta t} = \alpha \frac{\Delta Y_t}{\Delta t} \rightarrow I_{gt} = \alpha \frac{\Delta Y_t}{\Delta t}$$

$$I_{gt} = I_{nt} + I_{rt} \rightarrow I_{nt} = \alpha(\frac{\Delta Y_t}{\Delta t}) - \delta K_{t-1} \rightarrow I_{nt} = \alpha(\frac{\Delta Y_t}{\Delta t}) - \delta(\alpha Y_{t-1})$$

$$I_{nt} = \alpha\left[\frac{\Delta Y_t}{\Delta t} - \delta Y_{t-1}\right]$$

And from the net investment relationship, α can be obtained and after that: we have $K_t = \alpha Y_t$ that regarding the above relation, industries-related capital stock has achieved for desired years. All the relevant statistics have been extracted from the Statistical Center of Iran site and a census of industrial enterprises with 50 workers and more.

The introduction of pattern and model estimation:

Based on the empirical studies mentioned, in order to examine the impacts of investments in ICT on the country's industry sector, the following pattern is used:

$$LnY_{it}=F(LnL_{it},LnK_{it},LnICT_{it})$$

$$LnY_{it}=\alpha_1 LnL_{it}+\alpha_1 LnK_{it}+\beta LnICT_{it}+U_{it}$$

LnK_{it} : The logarithm of the value added of industry sector
LnL_{it} : The logarithm of workforce
LnK_{it} : The logarithm of investment in non-ICT sector
$LnICT_{it}$: The of investment in ICT sector
U_{it} : logarithm Model random error component
it : Representing industry and time respectively

Gathering statistics, to estimate a model, the panel data method is used. So, first to determine the presence (or absence of) the width of a separate source for each of the industries, the F statistics is applied. The result indicates rejection of zero hypothesis (i.e. at least typical squares). Then, to determine whether the method of fixed effects or random effects should be used in a model, Housman test is applied. K2 statistics 0.00 with P-value has been estimated approximately 0.95 using Excel and Eviews 6 software that indicates the use of fixed effects for model estimation.

As it is clear from the results of pattern estimation, variable coefficient of the investment growth in information and communication technology is positive and its coefficients are statistically significant (at the level of probability 0.95). Based on the estimated model in the period 1999-2010, this coefficient is 3.22. The results of the model estimation suggest a significant and positive effect of ICT on the value added of country's industry sector confirming the research hypothesis. The results represent a strong and positive effect of information and communication technology on the added value of industry sector that can expand investment in the ICT field and take advantage of this investment in various industries.

The variable coefficient of investment in non-ICT sector is equal to 7.44 (at the probability level 0.95) showing a positive and significant effect. In comparison between investment coefficients in ICT and non-ICT sector, it is considered that investing in non-ICT sector has more effectiveness and such a result suggests that the country's industry has not been converted to a fully favorable place to take advantage of the ICT capital yet.

Another examined variable is workforce with a coefficient equivalent to 1.83 (at the level of probability of 0.95) indicating a positive and significant effect.

The overall results of estimation indicate that first, 96% of a dependent variable is described by above independent variables. Second, coefficients of investment in ICT and non-ICT sector as well as workforce have expected signs and statistically are at significant and acceptable level. The results of this research with studies done on the effect of information and communication technology on the economic growth suggest that the relationship between ICT and economic growth is positive and consistent, because while information and communication technology is created on the value added, it has a significant and positive effect on industries and since the growth of value added of industry sector leads to the economic growth, we can reach this result in this research that information and communication technology with a positive impact on the value added of the country's industry sector can have a significant effect on the country's economic growth.

In this study, after overall significance of the performed regression is determined, we will test the amount of ICT effectiveness on each reviewed industry.

RESULT AND DISCUSSION

Specifying the importance degree of the information and communication technology on the country's economic growth, in this study, we seek to examine the effectiveness of ICT on the value added of industry sector which is one of the most important factors in creating the economic growth in the period 1999-2010 in Iran, and the results suggest a positive and significant relationship between the reviewed variables.

Considering the model estimation and review of tests, the results of the estimation of value added of the country's industry sector as well as information and communication technology done by a panel data model show that information and communication technology has a significant positive impact on the country's value added. Also, the effect of ICT on variables such as workforce and non-ICT capital on the value added of the country's industry sector is also positive and significant.

And in addition, the study of ICT on each industry indicates that among selected industries, optical and medical instruments as well as food and beverage industries with significant coefficients have respectively the first and second rank 0.83 and 0.55 among other selected industries. In general, the emphasized results suggest that the ICT variable provides ways to achieve growth in the country through creating the value added of industry sector that is one of the important factors of economic growth. So, it

is essential that countries pave the way to reach the economic growth through the extension of using this capital. In order to achieve this goal, the following recommendations are offered:

1- Due to insignificant capital share of ICT to the country's total capital and the lack of proper infrastructure as well as required conditions for the operation of this capital, the most important suggestion is investment growth in the ICT sector, ICT capital share increase to the country's total capital, and the creation of appropriate infrastructure, including cultural and social infrastructure to take advantage of more opportunities and benefits of this technology.

2- According to the results obtained from this research, ICT activity has a significant and positive effect on the added value of the country's industry sector. Therefore, it is recommended that ICT-related activities in this industry are supported by government. This support can be referred to as different methods, including direct financial incentives (government's direct financial assistance like subsidies and lending) and indirect financial incentives (tax forgiveness).

3- In order to reduce the gap between industries and other leading industries in the field of using ICT and creating the value added; and to promote the share of each of the industries, government legislation in this field and the creation of the necessary platform on monitoring and enforcing rules can play an important role in the advancement of the ICT capital among industries. Mentioned rules of the law are specific to the information and communication technology that the provisions of the mentioned law can be greatly fruitful in the more effectiveness of ICT in various fields including the country's industry sector.

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