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Utilization of Information Technology (IT) in Management of Environment

Mandana Saniei

Assistant Professor in Communication Sciences at Department of Mass Communication, Faculty of Humanities and Social Sciences, East Tehran Branch, Islamic Azad University, Tehran, Iran

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ABSTRACT

Information technology as one of the novel technologies of this century have been made dramatic changes in various areas of data management and information. Such practical cases is applying it in environment section for organizing and accessing the variety of data and information in order to optimal management of the environment. The purpose of this article is EXPLaining the information technology in designing and implementation of a system of environmental data and detecting the impedimenta and the existent problems in performing it in environmental organs, this article is searching for examining this subject internationally. For this purpose, after the theoretical review of discussion and extraction of the concerned model by using the method (Panel Data), engaged in estimating the effect of information and communication technology (ICT) on environmental quality separately in 2 groups of the developed countries and developing countries (such as Iran) for the period 2000-2010. The results indicates that with increase of extremity of pollution consulted of economic activities coincidentally ICT could moderate the growing process of accumulation of pollution in developed countries and improves the quality of environment through this way. However, in developing countries it is not so noticeable. It seems that the difference between developing and developed countries plays a significant role in this regard in institutionalizing the use of information and communications technology.

KEYWORDS: ICT, environment, pollution, Panel Data

INTRODUCTION

During the recent decades, the importance of the environment is gradually increased and the quality of the environment enjoys a significant importance. As with growth and development of the societies, the quality of environment is emphasized, and despite the basic differences in meaning and nature of the problems of environment in developed and developing countries, the generality of this subject is visible in all countries [9]. For example, while in developing countries, the main problems are the cases such as environmental degradation resulting from the unprincipled acquirement of resources, lack of evaluation and measurement systems (monitoring), lack of effective environmental rules and phenomena such as pollution refuge etc, in developing countries issues such as efficient use of resources and finding the optimal alternatives for them, management of release and excretion of pollutants, responding to public opinion (for example in the field of environmental NGO), the environmental arrangements compliance, etc are the main concern [10]. As mentioned, despite the differences in the nature and meaning of problems in environment of developing and developed countries, the environmental management and movement in order to maintain and improve it, is an international concern [13]. Therefore, any solutions and tools that can assist countries in this regard can be considered as a general solution. Exploitation and use of ICT and its capabilities and consequently the transfer of activities to the virtual world, is considered one of the most important (substrate) and the guidelines in this respect, whether in developed countries or in developing countries [15]. Explaining that in the ICT has been one of the important factors in evolving human life in the recent decades and now almost no part of human life (either directly or indirectly) is found that not exercised the capabilities of this technology. While undoubtedly a substantial part of the economic development of countries, particularly developing countries thanks to ideal utilization of the capabilities of this technology and the opportunities made by it, have been created during the recent decade [12]. Figure 1, shows a general picture of the influence of ICT in various aspects of human life. As you can see, different parts such as health and hygiene, employment opportunities, business, security, environment, regional development, human rights and education would benefit the capabilities of this phenomenon, while in many cases the relationship can be mutually [13].

*** Corresponding Author:** Mandana Saniei, Assistant Professor in Communication Sciences at Department of Mass Communication, Faculty of Humanities and Social Sciences, East Tehran Branch, Islamic Azad University, Tehran, Iran. mandanasaniee@yahoo.com

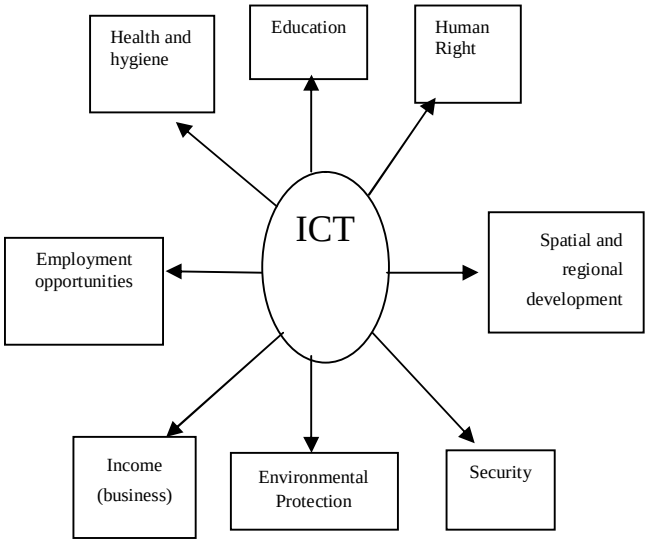

Figure 1: Developing Community ICT Development
Source: [16]

In this context, the use of capabilities of ICT in different fields undoubtedly deposited and deposits significant implications in the field of environment and this is due to role and importance of the environment, especially in recent decades can be considered as a special case. So, it seems that the study of consequences of using ICT on environment in different countries with different development levels, can bring new achievements, especially for policy-makers. Overall, the subject can be studied from different aspects, regarding the effect of ICT on environmental domain. Because the meaning and implications of using this technology can be studied and observed in various aspects of human life. In the most complete presented classification of the impact of ICT on environment in three separate categories are divided as follows: [2].

A– First tier (level):

In this level, the section of consequences (outcomes) of environment of ICT which is directly resulted by producing the equipment of this field and their usage that called direct consequences is investigated; which are divided to 2 groups: positive and negative consequences. Negative consequences, it is part of the environmental consequences of the production process, including ICT production of computer hardware, network cables, monitors, the consequences arising from the repulse of ICT equipment and elimination is obtained. The positive consequences are more beholder to the capabilities that can be achieved in the production and supply of ICT products. For example, contamination indicator electronic devices, electronic controls etc.

B - Second tier (level two):

at this level, that part of the environmental impacts of ICT (such as the usage of ICT in the production process, distribution and consumption) is considered, which effects large sectors of the economy in terms of virtualization and increase the access of economic agents.

C- Third tire (third level):

The surface returns to that part of the stimulating and motivational consequences of ICT that causes increase of using the total economy (in comparison with the case of not using ICT) the channel to higher economic growth, which are known as impact of the reactionary and returnee. The remarkable point in this regard is that, it is not simply possible to calculate the impact of ICT reactionary. As in mass economy some new demands create because of use of capabilities of ICT through economy's growth that for instance cause increase of raw materials and energy's demand. Furthermore, the utilization of ICT reduces the use of energy carriers and raw materials which can partially neutralize each other's effect and what is observed in practice, is the resultant of these two effects. This explanation is necessary that, the approximate amount of each of these effects (the three mentioned) are not the same and undoubtedly whatsoever comes as the consequence of the use of ICT in second place, is more notable than the two other which is the subject of this paper. Studies in which study of the effects of ICT on the environment are

discussed. It could be argued that no study is observed which specifically exhaust the effect of ICT on environmental quality in the country. However, of the worldwide studies the following can be mentioned:

[11] Investigates the impacts of ICT on environment with negative attitude in its study. This article is classified in the first category are presented in the review of the theoretical framework. This means that if the production's process and waste disposal management in the ICT hardware products is not done carefully, can be associated with serious environmental consequences as, in some instances, positive outcomes affect it. [11] [17] were examined all available studies carried out, including: articles, research projects, dissertations etc. which reviewed the study of the impact of ICT on business and the Electric allocate on environment in their paper. They claim: whether studies have been done in a case-mining and micro-level or macro-level studies that have been conducted in the form of the statistical attitude still didn't convergence completely in regard to apparent effect on the process of usage of ICT on sustainability of environment [17]. In other words, a review of studies still doesn't make it possible to express a judgment about the impact of ICT on environment and still we need new studies and methods.[2] have achieved the same results as obtained in the above article in their study [2]. [1] Have studied the effect of ICT on sustainability of environment, and while they have separated the various applications of ITC, they have investigated their effects on different sectors [8]. The results of this study which was carried out in descriptive form, generally indicates a positive effect of ICT application on reduction of greenhouse gases production, municipal garbage recycling rate and energy consumption [4].

MATERIALS AND METHODS

Method introduction

Regarded to theoretical considered in this section, the impact of ICT on environmental efforts within the kuzent hypothesis is investigated. For this purpose the model of Grossmann and krueger the adjustment are used as follows:[6].

Eq (1)

$$LNP_{it} = \alpha_0 + \alpha_1 LNY_{it} + \alpha_2 (LNY_{it})^2{}_{it} + \alpha_3 LICT_{it} + \alpha_4 LPD_{it} + \varepsilon_{it}$$

in equation(1)"L" represents the logarithm of the variables, α_0 shows latitude of origin and $\alpha_3, \alpha_2, \alpha_1$ and α_4 are regression coefficients. The variables are used as follows:

LNP_{it} :logarithm of air pollution index (per capita), the logarithm of per capita emissions NOx - tons/person

LNY_{it} :Logarithm of per capita GDP– dollar/person

LNY_{it}^2 : square of logarithm of per capita GDP – dollar/person

$LICT_{it}$:ICT indicators (logarithm of the diffusion coefficient of internet) internet users per thousand

LPD_{it} :logarithm of constructive mode concentration of population – person per square kilometer

ε_{it} : Error Expression

Increase of human activities, specially after industrial revolution has caused air pollutant in form of gas or fine particles suspended in air. some of the emissions are: nitrogen oxides in different shapes (depending on the number of oxygen atoms). Approximately, all nitrogen dioxide in the atmosphere is produced by human activities. Types of vehicles and powerhouses that use fossil fuels, are the major sources of emissions of these gases.[1]. Therefore, in this study NOx's emission rate is selected as an indicator of pollution (dependent variable). Among the many national and international studies have also demonstrated the environmental Kuzent's hypothesis of NOx emission have been used as an indicator of air pollution in this regard, these studies can be cited to [3; 7; 5]. Also to show status of ICT of the countries, the internet users coefficient is used as the number of internet users per thousands people are expected to show the differences between countries in this field. As expected, this variable coefficients (depending on model) shows the impact ITC on pollution index [14].

Estimation method:

Kuzent model estimation method in this study is based on combined (panel) data. This method is a combination of "time series data" and "cross section data". In each of the methods, time series and cross section

data, there are deficiencies in the integrated model which can be reduced [1]. 2 tests are performed in data integration methods.to determine the Y-intercept case can differ from country to counry within a country of origin of "F" test and determine the fixed or random effect, Hasman test is selected. Next, unit roots test performed and indicated that all variables are integrated from the first order and the data integrated the test mass, it shows the mass relation between pollution index and GDP per capita index of ICT and connection of population.

RESULTS

Model selection methods combined data (given access to information) is estimated for the period of 2010-2000. All the estimated coefficients are consisted with our expectations and theoretical framework and according to the test. All regression coefficients except of a group of Asian countries in form of ICT indicators and statistically significant at the 98% level are acceptable.

Table (1): results of the estimation model for selected countries(the dependent variable LNP)

Developed countries		Developing countries		explanation
statistic t	coefficients (α)	Statistics t	Coefficients (α)	
56/1	12/5	45/2	66/1	***LNY***
66 /2-	26/0-	89/1-	8/0-	***LNY^2***
51/1-	06/0-	22/0-	001/0-	***LICT***
43/1	55/1	06/2	86/0	***LPD***

Table (1) the values of the first and second columns, respectively are represent the coefficient of each country (α) and amount of (T) statistics. As you can see the positive coefficient of the log of per capita GPD in the 2 models of above, indicating the increment of pollution to GPD. In other words the income increment of pollution has trend revenue. This coefficient said the fact figuratively that economic growth (increase in revenue in the early stages of growth) is associated with creation of pollution and increase of environmental degradation.

This coefficient is estimated for developed and developing countries, respectively 1.66 and 5.12. but, as will be seen, the coefficient obtained for the log of per capita GDP squared variables (which indicates high level of economic growth) is negative .this ratio is indicative of the trend of relationship between income and pollution. In other words, this coefficient indicates that part of Kuzent curve, which is the turning point in the downward direction. Coefficient obtained for the concentration of population is positive. This means that increasing of population in an area, air pollution increased too. This coefficients indicated that if concentration population increase 10%, provided other conditions are constant, the rate of infection level 1.55% in developed countries and 86% in developing countries will increase. As you can see, the absolute values obtained for the two group studies countries are significant proportions which could indicate a significant impact on human life and the consequences of pollution. Comparing the absolute values obtained for variable economic growth indicate that the positive trend in the first half of the Kuzent crave slopes is over upward between economic growth and pollution, but in the process slowing it down and second half of Kuzent slope reduction has increased. In other word, Kuzent curve is not systematically shaped and slope (upward) in the second first half more than the slope of the curve (downward in the second half). This situation in figure 3, is illustrated. Coefficient obtained for the different groups of ICT for developing countries is not significant at 95%level. But the coefficient for developed countries is a parallel development of ICT.

This coefficient shows:

If developed countries as much as 10% interpretation increases other condition being constant, the amount of pollution 0.3% decrease. As you can see this coefficient indicates that the activities in the field of ICT and a significant role in reducing damage to the environment.

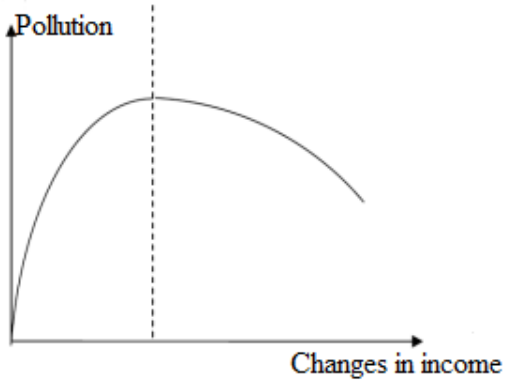

Figure3: Kuzents curve for developed countries

In comparing the relative effect of ICT application in 2 groups of countries can be seen that the positive impact of ICT on the (reduce) environmental quality in developing countries (in Asia) is the combination of "time series data" and "cross section data".

Conclusion:

In this paper the relation between ICT and environmental pollution in both developed and developing countries over the period 2000-2010 were analyzed according to the Kuzent hypothesis. The results indicate the existence of an inverted U-shaped. Relationship between GDP per capita and indicators of pollution. The model were estimated on the basis in developing countries a significant correlation was found between ICD and reducing air pollution. While developed, countries, this relationship was significant and substantial. So, it could be argued that the development of ICT activities aside from favorable consequences on the economy may also have an environmental consequence to be too good. It seems that the main reason for this transition a significant purport of the daily activity of economic. social, cultural, administrative and other such phenomena in the physical form into cyberspace and electronic commerce-government, E-learning, E-health and some of this is outline in figure1,was depicted (illustrated). In this regard the following can be cited as examples:

A- Administrative task, such as: real estate registration, passport, application, etc. in the electronic environment.
B) banking activities, such as : paying bills withdraw and transfer money etc. In the E- environment.
C- Recreational activity: computer games and visiting museum galleries and exhibition in E-form.
D- Information like: reading newspaper stories, knowledge of weather, candidature, traffic, flight hours, aircraft etc. in E-form.
E- Commercial activities such as: buying and selling goes, music, films, training system in E-form.
F- Scientific activies: do searching , finding an article, achieving, sources and in e-forme.
educational activities, such as: university courses, training etc., In E-form.
G) politic activities: such as participation in election, taking part polls, etc. in cyberspace.
H)activities of travel like: booking travel tickets, hotel reservation and care live in E-form.
I)employment and labor demand as: awareness of job, opportunities job application from to fill in an electronic from
K) the foregoing are examples in which ICT capabilities in shading, visiting cyberspace is sharply reduced and transfer to cyber (electronic)space. The more obvious outcome in this situation is reduction of demand for transfer, using of different kind if energy carrier, so better quality or reduction of risk of environ .overall, no significant effect on the reduction of air pollution in the form of ICT model estimated in this study. It was proved for developed countries. But developing countries are required to further study and time passing.

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