

Spectrum of Cyber World Security Issues and Analysis of its Effects on Sustainability of ICT

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Abstract

This paper is a survey of the fancies of the multi-dimensional cyber world, and the security issues effecting the sustainable development of the ICT sector. The authors have defined sustainability as a multi-facet entity, which has social and economic progress as its independent and mutually reinforcing pillars. The paper also analyzes the reasons for the digital divide which is found to be primarily caused by the security issues that are inherent part of the cyber world. These security issues are affecting the sustainable growth of the ICT sector and various other sectors dependent on it. The authors have also suggested some precautionary measures and best practices that can be followed by the individual and organizations which can ebb the fears of users and help in long term and sustainable development of ICT sector.

Keywords

Sustainability, ICT, Security, Digital Divide

I. Introduction

The Internet is growing at an unprecedented rate which is far faster than anybody had imagined at the inception phase of the Internet. Today a considerable number of world's population is connected to the Internet and scores of our day to day activities are dependent on Internet and other forms of Information and Communication Technologies (ICT). There are numerous fancies that are attracting more and more people to the internet nowadays. The words 'Cyber World' or 'Virtual World' are synonyms of the world-wide Internet. Interestingly the word 'Virtual World' is quite appropriate, as the Internet offers a wide array of capabilities, applications, and attractions, some of which are very real but others are very perplexing, fictitious and their existence and authenticity is very difficult to establish, for example, we use the Internet for various activities such as searching for some information, buying and selling things over the internet, i.e., E-commerce, online booking of tickets, e-governance etc., these are considered to be more or less real activities on the Internet, but activities such as online gaming, online chatting, social net-working and all kinds of simulation activities are considered to be virtual activities as the user never knows what or who is he interacting with. In such applications people are normally attracted to people and things that do not have any existence in the real world.

The ICT sector is affecting the home user as well as the other service sectors of the society in a uniform manner, e.g., now-a-days, not only the Information Technology (IT) and Information Technology Enabled Services (ITeS) sectors but all other kinds of industries are heavily dependent on the ICT. If we consider the example of aviation industries, today 90% of their business is being done over the internet with the use of online transactions, the traditional industries such as manufacturing industries, medical and pharmaceutical industries, education, entertainment industry also rely heavily on the ICT.

Information and Communication Technology now-a-days is widely available and approachable in terms of price and accessibility and it can be used for moral and legitimate purpose as well as for immoral and illegitimate activity by a miscreant. As the user gets "wired" to the Internet he, in ignorance, also gets vulnerable to all the security threats that are integral part of the cyber world. The vulnerabilities on the internet come in many forms such as the: Hacker who would intentionally hack user's system and misuse it for malicious activities, the threat from the viruses that might harm the users system, the various kind of spyware which can steal the user name and passwords from your system and send them to some particular location, adwares which might constantly irritate the users with different kinds of sale offers, the organizations can also be victimized using attacks such as Denial of Service(DoS) attack, Packet Sniffing, E-mail spoofing, cross-site scripting and many other vulnerabilities that are being discovered every day.

Despite all these challenges it has been observed that the number of active users of the internet are increasing at an exponential rate and the dependencies of various service sectors on the Internet is also increasing at the same rate but still the sustainable ICT development is not on expected lines. The ICT sector has a huge potential to affect the social and economic status of the society for the contemporary as well as future generations. The main challenge that needs to be addressed is that the organizations and society has to learn how to deal with the security issues of the virtual world so that the benefits of the ICT sector can be utilized in the best way without the fear of the loss that it can lead to in case of security breaches.

II. Sustainable Development

The most commonly stated definition of Sustainable Development is the famous Brundtland Report [3] definition "A consistent development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs". This means that sustainable development is a pattern of resource use that aims to meet continuously and at a steady pace the human needs while preserving the environment so that these needs can be met not only in present, but in the indefinite future. The field of sustainable development is conceptually broken into three constituent parts: Environmental sustainability, Economic sustainability and Socio-political sustainability. Only the Economic and Social aspects of sustainability are considered in this paper as Environmental aspect is being taken up in other researches and warrants considerable environmental set-up.

Fig. 1 shows economic development and social development as independent and mutually reinforcing pillars of the sustainable development.

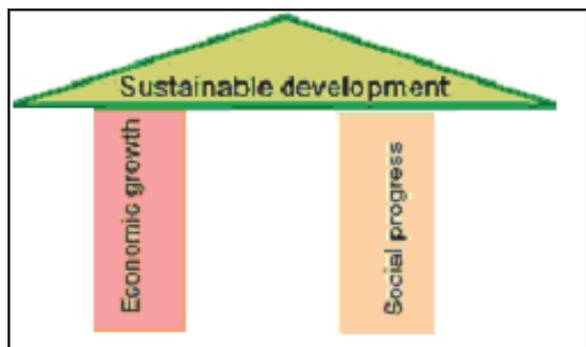


Fig. 1: Sustainable Development Pillars

The ICT sector has been growing at an unprecedented rate. In the next section of the paper, it would be established that the ICT sector has brought more prosperity and economic and socio-political growth to the society in last 15 years than what the great Industrial Revolution of the 19th century brought in 50 years. The ICT sector is still in its infancy and the potential that it has, is not being exploited even marginally as we see that there is a huge disparity in the penetration rate of the Internet in various parts of the world. For the sustainable development of the ICT sector we have to analyze the factors that are effecting its growth and find suitable solutions to provide a conducive environment for its sustainable development.

III. Economic Effect

It is a well known fact that the ICT sector has been the single largest factor propelling the economic growth in the last two decades. The impact of ICT on the global economy has been studied extensively using the sample size of 13 countries including the G8 countries and South Korea, Sweden, China, India and Brazil [6]. Today at least about 2 billion people use the Internet and ICT and more than \$8 trillion exchange hands through e-commerce. The ICT sector alone has 3.4 percent share of the total GDP in the sample, and in some developed countries, the share is more than 6 percent. The ICT’s impact on GDP comes from four factors, Private Consumption, Private Investment, Public Expenditure and Trade Balance. ICT sector has more contribution in the GDP than the education, agriculture, utilities and other traditional and well-established sectors. It would be interesting to note that the potential that ICT has, is tremendous and even a small fraction of it has not been exploited till now as even in the sample countries, which are developed countries or the countries which have a very high penetration of the Internet, ICT had impact between 0.8 to 6.3 percent in the GDP and the global variance would be much higher.

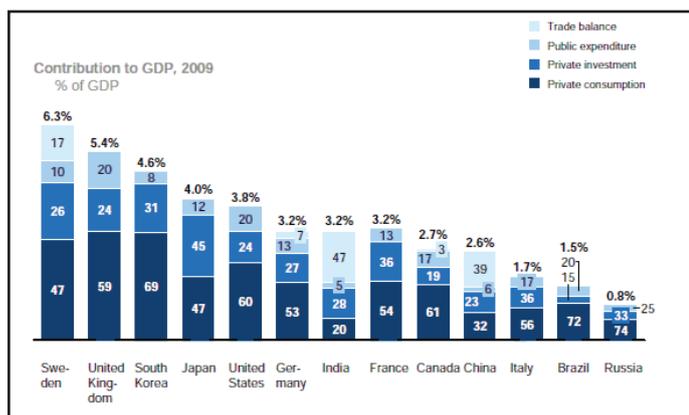


Fig. 2: GDP Contribution of ICT

It has been established in an economic survey [7] that the ICT has enabled the GDP of \$500 on an average in developed countries. It has also been identified that 75 percent growth has come from the traditional companies that are not related to ICT but could increase their economic viability and prosperity by making use of ICT for increased productivity and efficient use of resources.

The computer and later the Internet were considered to have a negative impact on the job market but it has been found that although ICT has led to depletion of certain jobs globally, it has contributed substantially to job-creation as well, for every job that has been lost, 2.6 jobs have been created by the ICT sector. The real economic growth globally has been due to the penetration of the Internet in the remotest suburbs of the world and the Small and Medium Enterprises (SMEs) using the ICT technologies to increase their productivity and use Internet to reach to the world using e-commerce website and other information and communication technology enabled services.

IV. Social Effect

Although the social progress is largely effected by the economic aspect of any society, which stands proved to be highly influenced by the ICT sector, it also effects the other aspects of social development such as, increase in literacy rate and level, networks helping small and medium-size enterprises (SMEs) to exchange information and experience among themselves, E-services for weather reports, healthcare and medicine, purchase prices, financial forecast, investment opportunities, E-governance etc. In the study of infoDEV projects [5], several ICT projects have been proven to affect the social status of people across the globe, for example, “B2Bpricenow.com” in Philippines contributed to the social and economic development of farmers and fishermen by direct marketing to the customer online, eliminating the middlemen and creating new marketing channels. A project “Cemina” in Brazil used ICT communication to broadcast education and economic opportunities information to women. Another project called “Future Station” used ICT to make people aware of the situation in slums and changed the way people perceived their situation. Another major contribution of the project “Peoplink” needs to be mentioned, which encouraged the idea of Home Tourism, which in turn, helped in increased status of remote families by advertising to the prospective international customer which eventually led to thousands of bookings online. An ICT project “Voxiva” in Peru lowered the vulnerability of the poor to income shock by improving disease surveillance in the remote areas of Peru. A project called “SITA” has trained local women in ICT skills to enable them to gain employment. Gender barriers to employment opportunities prompted SITA to subsequently create an e-cooperative that could provide both training and jobs to women.

All these projects have established the impact of the ICT sector on various social factors of the society and it has been demonstrated that ICT sector has huge potential to tackle the social causes of the society.

V. Digital Divide

The Digital Divide is the differentiation between the people who have and do not have access to the Internet and other forms of ICT technologies and it is now a leading global civil and economic right issue [8]. Despite the tremendous potential of ICT sector, the growth has not been as anticipated initially mainly because of the vulnerabilities to which the users are exposed when they are

wired to the Internet. The security concerns on the internet comes in various forms such as credit card abuse, divulging of private information, downstream liability, identity theft and loss of other resources to name a few. All this leads to the lack of disposition of trust of the individual in the institution called “The Internet”.

VI. Security Measures

In personal management there is a term called “Catch them young” which is also applicable to the security. We need to build the software that achieve the desired functionality and performance goals but with fewer vulnerabilities. The first line of defense against the vulnerabilities in any software is to develop the software in such a manner that it has minimal scope for the exploit to be introduced in the system. Especially the software which is in the front line during the interaction of the system with the internet should be considered as safety-critical and developed using the methodologies such as suggested by UK Information Technology Security Evaluation Criteria (ITSEC) [12]. Such criteria would require that stringent and formal process is followed during the requirement analysis, system and detailed design, development and testing of the software.

The next level of defense is always in terms of the security products that can assist the judgment of the IT staff and go a long way in securing the organizational and personal computing resources. A multi layered approach using a Filtering Router, Firewall, Intrusion Detection and Prevention system and possibly a Honeypot should be installed in an organization. The network security essentially has to be multi-layered as a single level security is usually doomed to be compromised.

The other important adage about the security is “Patch the Hole” which means that the software that are being used on the system, either the application programs or the security critical programs such as firewalls, browsers, email client etc, should be patched diligently. There is, however, a good point about these exploits that they are preventable, if proper action is taken promptly. On 18 June 2001, Microsoft released a patch for the vulnerability that Code Red worm exploited—almost a month before Code Red’s release. The Nachi patch was released in July 2003, and the Nachi worm didn’t appear until almost a month later on 11 August 2003. Finally, Microsoft patched the vulnerability that Sasser exploited 17 days before this worm appeared on 30 April 2004 [13]. None of these worms would have been nearly as successful had organizations and individuals patched their machines in time.

All the security approaches that we have mentioned above are reactive and proactive defenses but the real key to survivability approach is that, instead of secure systems, IT professionals should develop on survivable systems which emphasize survivability in future attacks [14]. These methods hold the scope for the future development in the ICT security and are widely being explored and implemented by academic and professional researches through out the world.

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