

# RAPIDLY EVOLVING INFORMATION AND COMMUNICATION TECHNOLOGIES – DRIVING FORCE FOR HOLISTIC ECONOMIC DEVELOPMENT

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## **Abstract**

*In the past two decades, there have been many changes related to the economic development in the society. The geographical boundaries are blurring and all this is happening due to the evolutionary development in the Information and Communication Technologies (ICT). Though the momentum is more in developed economies but the developing economies are fast catching up. Plethora of data is accumulating with breakneck speed. In order to clean, filter, store, analyze, use and disseminate the required information in the field of economics, capabilities of computing devices and services have been of great assistance. Over the time, networking capabilities have also enhanced, which have provided further fuel for the holistic growth of economies. This research paper relates the use of emerging trends like datafication, big-data analysis, cloud computing and smart systems which have revolutionized the basic working models of economics. These capabilities have implications for all the sectors of economies – the way, in which the production and consumption processes are evolving, the businesses and markets are functioning and changing, work of the various levels of governments and the citizens in general.*

*Keywords: Big-data, Cloud Computing, Economic Development, Holistic Growth, ICT, Smart Systems*

## **1. Introduction**

The advancement in economies or rather the stages of development depends upon the advancement in science and technology. The industrialization had transformed the mass agrarian economies and as a result changed the status of the nation states. The next big leap in economies came with the advent of the information and computer technology. This technology indeed has the potential of transmogrifying the basic economic structures. As a further link to this chain, is the adoption of cloud based services. The virtual world is gradually becoming more and more real as it is not only about products and services but behaviour also. Information and computer technology is opening several new dimensions for the businesses which will assist in

- (a) Scaling down the risks,
- (b) Cutting down the costs,
- (c) Broadening scope for innovative business practices and
- (d) Enhancing system capacities.

It will empower not only businesses, but also people, governments and organizations in general. In a nutshell, it will accelerate the rate of holistic growth. It further has impact on the behaviour of the stakeholders as the virtual world is shattering the national boundaries, hence asking for regulation of changing nature of markets. The regulators and policymakers have to be more careful and futuristic while formulating and amending policies, regulations and laws. Another related issue is of employment – several traditional jobs will be cut down but on the other hand jobs in newer avenues will be created. Although developed economies are forerunners in this field but developing economies are catching fast. The pace of globalization is increasing tremendously.

Section II of the paper discusses the influence of ICT on various economic activities and section III deals with the emerging trends in ICT like datafication, big data analysis, cloud computing and use of smart systems.

## **2. Influence of ICT on Economic Activities**

ICT has revolutionized the nature of communication and interaction. The world as a global village is undergoing a transformation in this regard which is equally affecting the economies, societies, institutions, individuals and the culture as a whole.

*2.1 Worldwide Integration of Production:* The connectivity level of any country determines the altitude of benefits that a country can reap from the globalization process. In terms of ICT, the global positioning and boundaries are all in connection to the cyberspace. ICTs provide the pathways with which the world is brought together, conquering both time and space. The critical role of ICTs here is that they allow the flow of information and market intelligence at incredible speed and at very low cost. This means that multinational corporations have better access to the most comprehensive market intelligence; they can better coordinate their activities and management (YA'U).

*2.2 International Trade and Distribution Networks:* With the improved transportation system, the international trade expanded. But with the advent of information and computer technology, it can take gigantic steps. It makes possible to manage diverse customers, products, services, production plants and facilities, etc. located in different countries. These services help in gathering, collating and managing data related to products and services.

Such information is further used to prepare appropriate logistics for balancing the demand and supply of these products and services in time, keeping in view, the facts related to shelf life, inventory size and transportation time, etc.; the prime factor being minimizing the affiliated costs. Today thanks to ICT, Multi National Corporations have access to remote markets and for cost minimization; there are numerous subsidiaries, production plants or assimilation plants located in different countries. Automation processes are increasing in number not just in production but distribution and logistics. For facilitating these processes, the use of electronic commerce, electronic business, Global Positioning System (GPS) and Electronic Data Interchange is becoming indispensable.

The usage of Global Positioning System in trade and commerce and Electronic Commerce (“Transport Logistics”) is widespread in developed economies but there is a vast scope of adoption and expansion of these in developing countries. As the basic aspects related to ICT such as the speed availability, global connectivity, quality of available systems are a great matter of concern in these countries, they

need to put more efforts in this direction first. If such requirements are not fulfilled and quality standards are not maintained, then it will not only hamper the growth of local business but also the enhancement of business activities of Multi National Corporations. The developing economies have to be prepared for handling the surge in traffic (both physical and virtual).

Another aspect to be discussed in this reference is the problem of negative externalities related to increasing transportation system. In order to deal with the burgeoning freight flows and long distance transportation, the efficient use of ICT can reduce the time as well as control the negative externalities. This requires comprehensive planning and coordination of logistics at both local and global level.

2.3 *New Patterns of Consumption of Goods and Services:* The pattern of consumption of goods and services is getting a complete facelift. A wide range of new products and services are now available which were hitherto unheard of specifically services. Online shopping, auctions, gaming, chatting and messaging (or social networking in general) and trading are some precedents of this transforming pattern. Even the boundary between products and services is blurring.

2.4 *Financial Markets and ICT:* Another example of such game changing technology is today's financial markets or specifically the electronic trading of financial instruments. The traditional trading on the floor of the stock exchanges was replaced by high-speed algorithmic trading. Algorithmic trading is based on real time functioning. High frequency trading (HFT) (Cliff) is increasing at a rapid speed capturing around 50% of the total volume of trading in US with Europe and Asia following suit. Instead of traders' physical proximity to the stock exchange, today the proximity of the servers is important for achieving speed advantage, since the difference of a few milliseconds of latency can result in losses or gains of millions of dollars. The next wave of innovations on this front will likely come from trading software driven by self-learning algorithms (King).

### 3. Emerging Trends in ICT

#### 3.1 Datafication

The present era is the era of knowledge. In order to thrive, any economy relies heavily on the data collected through the day-to-day activities as well as the achieved data. Capabilities of computing devices and services have been of great assistance since 1960s; but today the biggest problem is this plethora of data, which is accumulating with gigantic speed. Digitalization has helped the economies grow so far, yet the move from digitalization to datafication will yield results in progressive multitude. Generally, by using digital technology, an organization uses data for carrying out critical business processes and also for strategic decision making. Since the latest demand in this competitive world is to convert an organization into a data-driven enterprise, digitalization alone is not enough. Digital technology through datafication is characterizing the way institutions and individuals need to interact and co-ordinate business related activities.

Datafication (Bersin) is a relatively new phenomenon which collectively refers to processes, tools and techniques which aid in transforming any enterprise to data-oriented enterprise. Datafication aims for mass customization, specifically carried out by and for the end-users. Through an interaction between the digital and the physical world, the knowledge associated with the physical objects is non-embedded. Datafication is going to make data the nucleus of not just business or government processes, but for the economies as a whole. By implementing datafication, service delivery, data access time and overall

cost is reduced; but issues like privacy, data security and data ownership are the challenging areas which need to be addressed.

### 3.2 Big Data Analysis

Data on economic activity was specifically collected in the pre-internet era. The data collection process and techniques were quite slow. The collected data was stored on physical mediums like paper, etc. for the first time, and then it was converted to the digital form, either manually or via scanning. This whole process was not only too slow, but it was prone to problems like data redundancy, incomplete data, lack of authenticity, etc., and finally, the data thus collected was quite scarce for carrying out predictive analysis.

As the internet has spread its wings in every part of the world, access to data footprint has become much easier. With the help of internet, if a person goes for online shopping, all his clicks are recorded. If he reads an article, watches a video, or likes a blog, his behavior is recorded. His likes and dislikes are stored whether he manages his finances, plays a game, visits social networking sites, etc. This heap of data when collected is being referred to as big data (Einav) which forms the base for market research and development activities. This type of data is equally sought after by the government and the Multi National Corporations. With big data, three major aspects come into the picture. The first is the type of data, second is the storage for this data and lastly comes the analysis of the data.

- *Varied types of data* : Talking about the types of data (Halkidi 17), in the pre-internet era, the majority of market oriented researches were primarily based on nominal data. With the advent of the web, the data is no more restricted to a particular form. In today's world, we are surrounded by nominal data, binary data, ordinal data, temporal data, symbolic data, multimedia data, and other kinds as well. Under the umbrella of big data, we get all the different types for different kinds of analysis.
- *Data Warehousing* : The storage of big data is another issue. Such data cannot be stored and accessed on simple databases. The general storage technique of relational databases used so far stores data in two dimensional forms, i.e. in rows and columns. These databases neither have the capability to store, nor access the big data. The usage of big data is meant for predictive modeling, and for that, one needs to see the existing data in different dimensions. This requirement paved the way for data warehousing (Raden). Data warehouses work on cube technology, which provides the data a multidimensional view.
- *Data Mining Techniques*: The general mathematical, statistical or econometric techniques used by statisticians and economists are insufficient for the predictive modeling. A new range of algorithms have been invented under the ambit of data mining (Halkidi 17) which work efficiently on the warehouse data. In order to characterize and evaluate patterns, data mining makes use of different fields like mathematics, statistics, artificial intelligence, machine learning, psychology, experimental algorithms, etc.

### 3.3 Cloud Computing

Businesses without internet were mainly privately owned processes where the enterprise had to invest a lot of money in procurement, installation, regular execution, maintenance and up gradation. This not only incurred ample of money, but also time and efficient manpower. A regular lookout for experts

who could manage the latest techniques and technology had been a great headache for any organization who craved to create a niche in the cut-throat world of competition. There has been quite paced up development in the world of ICT in the past decades, and making individual efforts on the part of an enterprise in order to keep up with the market has been very tiresome.

Using internet as the backbone, cloud computing (Jackson) has become an essentiality for seamless running of any kind of businesses. There is no longer a requirement to purchase and maintain the computing resources, whether it is hardware, software or services. All three are available on demand through the use of cloud computing. Any organization now can stay relaxed with no worries about the latest advancements. The first benefit for the economic growth comes with the connectivity through the network. There are no boundaries as to how much resources any business organization or even an individual can demand. The combined and shared pool of resources and services, which are covered in the shroud of cloud are easily scalable. Additionally, the best part is that both up-scaling and down-scaling is possible. So, there is never a risk of over-provisioning of resources. Neither is there a worry to think about any sort of updating in terms of software and hardware. Right from setup to installation, and from scaling to maintenance, everything is managed by the cloud providers. The user just has to pay for the service for the time the service is used.

The cloud that initially started its services with three base services, namely, software as a service, platform as a service and infrastructure as a service, has now extended up a whole series of services like storage as a service, database as a service, business process as a service, integration as a service, security as a service, testing as a service, and many others. This list of services is increasing day by day.

### 3.4 Smart Systems

A step further from the usage of individual smart devices is the use of smart systems.

“Smart systems combine data processing with sensing, actuating and communication and are able to analyse complex situations and to take autonomous decisions. They take advantage of miniaturization, and are often invisible to the consumer. They are highly energy efficient or even energy autonomous and can communicate with their environment” (“Smart Systems” 3).

Smart systems, though still in their nascent stage, can be the solution to diverse economic problems.

- *Energy Usage & Pollution:* Use of smart systems can lead to energy efficiency through the auto adjustment of temperature and light requirements within the buildings or vehicles according to the external weather/environment.
- *Demographic Variations:* Providing cognitive assistance to physically challenged people or elderly people in their living environment.
- *Increasing Mobility of People and Goods:* Intelligent transportation system and logistics can facilitate the movement of people in terms of speed and security and movement of goods in terms of in-time and demand-driven delivery.
- *Unemployment:* Centralized smart systems managing the skill requirements, qualifications, specifications of job requirements and job profiles with that of available human resources.

#### 4. Conclusion

For every economy, developing or developed, improving the quality of life is the primary goal of all developmental policies. For holistic development, it is necessary to identify such drivers that can provide momentum to the maximum number of sectors and side by side work on decreasing the costs affiliated to this pattern of development. ICT is the most promising driver of the present time. The opportunities are increasing and so are the concerns. The need of the hour is to learn from past economic growth patterns and their lacunas and be ready for the future challenges in order to harness the potential of the computer based techniques and technologies to the fullest.

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