

EMERGING STATISTICAL CONCEPTS AND DEFINITIONS IN THE INFORMATION ERA

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Abstract:

This paper attempts to discuss the need to develop official statistics about information age developments in a regular and systematic manner. Recognizing the limited work that has been done so far in this area, the paper attempts to provide a concise account about information age phenomena. It basically describes the technological and societal perspectives of contemporary information, communication, knowledge and entertainment systems. For the benefit of statistical community use, the paper attempts to provide basic working definitions on number of information age terminology, which is essential for formulating statistical surveys and data collation. These include knowledge hierarchy, Information Communication Technology (ICT), knowledge worker, information society et cetera.

1. INTRODUCTION

As we are aware, statistical concepts and definitions are fundamental requisites before embarking any new statistical collation. Like in the past when agricultural and industrial revolutions emerged, the statistical systems embraced timely review and gave rise to the present industry, product, and occupation and trade systems and regular statistics on population, agriculture, industry, environment et cetera.. Similarly, the present information era demands update in the statistical systems and perhaps requiring realignment and restructuring so that emerging issues such as formation of information society, information sector, rise of knowledge worker et cetera can be duly addressed. Such endeavor is imperative for formulating policies and programmes aiming at enhancing quality of life of people, productivity and competitiveness of economic entities. The preliminary investigation showed that the data in the present statistical system is limited and moreover, only a limited work has been done in addressing the measurement aspects of information age developments. However, it is a formidable task and requires adequate resources in terms of money, manpower and expertise to undertake all measurement issues simultaneously. Recognizing the limitations, policy and data gaps, this paper attempts to focus on emerging statistical concepts and definitions in information era phenomena. Prior to that, the paper also briefly discusses features and characteristics of information age phenomena.

2 INFORMATION AGE FEATURES

- 2.1 The development of new statistical concepts and definitions is essential for formulating survey questionnaires, conducting training and data collection and data processing and tabulation. This can only be achieved by understanding the features and characteristics as well as the structure of the new phenomena. In this regard, the features of information era are seen from technological and societal perspective.
- 2.2 The technological features that drive the information age are as follows:-
 - i) *Hardware development: On line connectivity and real time interactivity networks*, modes and products and services have made communication and information distribution more efficient and effective within national as well as across geographical borders.

- ii) *Data conversion* from analog signals to digital and vice versa using MODEM technology has enabled the convergence of computing and telecommunication technologies.
 - iii) *Software development*: Emergence of powerful and high-end software such as JAVA, HTML, and etc. has enabled the development of multimedia contents.
 - iv) *Content development*: Data preparation, information processing, distribution and utilization activity occur in great volume, speed, rate, scope and coverage.
 - v) *Data Communication*: Data and information coded in bytes or binaries or electronic signals are porous, easily transportable and readily sharable over the electronic network;
 - vi) *Technology evolution and convergence*: Advent of MODEM and high-end software is progressing from computing to present IT and into multimedia era.
- 2.3 As a result of people becoming an integral element in the contemporary information and communication system, the information age societal evolution is marked by the following features:-
- i) *System of governance*: The system of governance in all development spheres is evidencing change. In this regard roles, responsibility, relationship, norms and modus operandi in all institutional arrangements are under going structural adjustments.
 - ii) *Societal participation*: On line participation of community and non-profit sectors is increasing in the public policy and decision-making processes. Such societal and individual participation is progressing in the national as well as the international arena.
 - iii) *Business environment*: The business environment too is undergoing structural changes with the advent of e-commerce and k-economy activities.
 - iv) *Human relationship*: At work and play, human interactions are taking new dimension with ever growing global communication, chat groups, net-citizenry and et cetera.
 - v) *Work culture*: A number of new cultures are emerging in the work environment such as teleworking, information literacy, knowledge sharing, lifelong learning¹, and et cetera.
 - vi) *Knowledge explosion*: Traditionally, data, information and knowledge are very much confined to individuals and institutions. Connections between knowledge sources and nodes are constrained by geographical confines, time and rudimentary modus operandi, thus the availability; access, flow and sharing of information, knowledge and resources are rather restricted. Through global online connectivity and real time interactivity communication modes has given rise to accessibility to vast pool of data and information as well as increase in knowledge by many folds.
 - vii) *Emerging societal divides*: The world is encountering new shades of societal divides and characteristics differentials. These include classifications such as information rich and poor, which accentuates the existing poor and rich gap as well as urban and rural disparity. Rise of information and knowledge worker creates new demands in the workforce in contrast to those exercised by traditional classifications such as blue collar and white collar employees, professional and sub-professional, skill, unskilled and semi-

¹ Lifelong learning is a deliberate progression throughout the life of an individual, where the initial acquisition of knowledge and skills is reviewed and upgraded continuously, to meet challenges set by an ever-changing society.

skill as well as job descriptions depicted in Dictionary of Occupational Classifications (DOC).

- viii) *Quality of life:* ICT is generally perceived to improve quality of life. However, the new age technology has also its negative impacts. The traditional value, ethics and morals are also being challenged when individuals gain exposure to on-line and real time information that comes from various cultures and traditions across the globe.

- 2.4 As such, people worldwide are increasingly intertwined with ICT and becoming an integral aspect of information, communication, knowledge, networking and entertainment systems. In other word, “technology drives people today”. Since the inception of Internet Technology commercially, the number of people with on line connection is 377.6 million people in the world; Internet hosts has increased by leaps and bounds from 213 in 1981 to 93 million in 2000. In Malaysia, the number constitutes 870,000 Internet subscribers or not less than 3 million users.

3. EMERGING STATISTICAL CONCEPTS AND DEFINITIONS

- 3.1 The foregoing descriptions only provide an understanding of information age developments but not measurement activities. In measurable terms, the fundamental statistical concepts and definitions of information age phenomena that warrant attention are as follows:-

i) DATA, INFORMATION AND KNOWLEDGE HIERARCHY

Data are observable facts or assumptions. When data is processed in a meaningful context, it becomes information. Information becomes knowledge when one adds value to products and services through judgment and internalization processes. By incorporating the ‘appropriate’ moral and spiritual values, perhaps, knowledge can become wisdom².

ii) ICT

Contemporary Information Communication Technology (ICT)³ refers to information and communication products and services that have the following features:-

- driven by microelectronic technology
- on line⁴ connectivity *e.g. conventional radio, conventional television*
- real time interactivity⁵ *e.g. telephone, interactive radio, interactive television, e-mail*
- multimedia contents *e.g. web sites with audio-video and animation modes, television programs etc.*
- technology convergence. *e.g. web television, video conferencing*

² Being a complex and perhaps, controversial subject conceptually, the KIX model limits its measurement at data to knowledge level.

³ Standard text books define Information Technology as – term used to describe technologies that enable to record, capture, store, process, extract, retrieve, manipulate, transmit, distribute and receive any form of information. Therefore, in broader sense ICT also includes rudimentary technologies such as writing on papyrus, tablets, caves etc ; intermediate technologies such as printed materials, paper, pencil, document filing systems, mechanical accounting machines, printing and drawings etc.

⁴ A subsystem or computer that is operable and connected electronically to the main system;.. advent of Morse code transmission of coded signals using electric pulses over a geographical distance marked the beginning of on line communication.

⁵ The term real time connotes that the calculations for problem solutions are made at a time which coincides with the process that generates the data, without time loss in computations; similarly, in telecommunication refers to a spontaneous or instantaneous way of acting on another or with one another; in a spreadsheet a response in one second or five seconds acceptable; The earliest form of on line connectivity and real time interactivity was the telephony system which then dealt with audio signals only; today, video conferencing connecting two remote points incorporates audio, video and people besides on line and real time interactivity features.

iii) CONTENTS : TRADITIONAL/ ELECTRONIC / MULTIMEDIA

Traditional Contents⁶ are defined as data and information in spoken words or text or numbers or drawings or graphics or pictures, expressed in non-electronic media in the form of speech, reading, singing, vocal, printed media, carvings, paintings et cetera.

Electronic contents are defined as ICT contents with the following features:-

- spoken words or written text or numbers or drawings graphics or pictures, convertible to electronic signals;
- electronic signals in analog or digital mode;
- audio or video modes or combination of both;
- signals with animation or without animation (still images);
- transportable electronically singly or in an integrated form;
- communicable by on-line modes
- usable in an interactive manner
- subject to computing logic and manipulation

Multimedia contents are defined as electronic signals in combination of above. As such, multimedia contents can be categorized into :-

- off-line (e.g. *video games, video cinemas, “home theatre”, etc*
- on-line & non-interactive. (e.g. *web-based computer games, web based news broadcasting et cetera, conventional television and radio programmes*)
- on-line & interactive (e.g. *web based telephone call, web based live video conferencing et cetera*)

iv) ICT DIFFUSION

ICT Diffusion⁷ is the process by which ICT products and services is adopted and gained acceptance by individuals and organization.

v) INFORMATION ACCESS

In its broadest sense Information Access can be defined using the following parameters:

- physical possession and /or availability of information and communication equipment such as radios, televisions, telephones, computers, software and networks;
- financial means to afford and use ICT products and services;
- basic skills or capabilities to use and the actual usage of ICT products and services

(Source: INFOSOC MALAYSIA 2000 Discussion paper on “Access and Equity: Benchmarking For Progress”)

vi) ICT / COMPUTER / INFORMATION LITERACY

The basic meaning of the term literacy⁸ denotes “ability to read and write the symbols that represent the sounds of language”. The ICT usage pattern ranges from simple activities like tuning to radio, watching television, to complex activities like using fax and e-mail for communications, using computers for surfing Internet et cetera. The usage pattern also implicitly indicates the hierarchy of users involved in ICT. Acknowledging these

⁶ Contents means ideas and opinions in spoken or written form

⁷ Diffusion is defined as the process by which an innovation is adopted and gained acceptance by members of a certain community. A number of factors interact to influence the diffusion process. They are the innovation itself, how information about the innovation is communicated, time and the nature of societal system

⁸ In its most fundamental sense, the word literate comes from the Latin word “littera”, meaning “letter” – refers to ability to read and write the symbols that represent the sounds of language.

complexities, this paper defines the following three basic literacy terminology associated with contemporary ICT developments:-

- *ICT Literacy* – “ basic skills and ability to use ICT products and services such as radio, television, fax, phone, computer, Internet et cetera to accomplish a practical task” ;
- *Computer Literacy* – “basic skills and ability to use a computer and its software to accomplish a practical task”- a variation of ICT Literacy;
- *Information Literacy* – “ basic skills and ability to recognise when and what type of information is needed and to locate, evaluate, use effectively and efficiently to accomplish a specific purpose and communicate the content in its various formats”; - basically includes data preparation, information processing and dissemination.
- *ICT Literate* -has basic skills and capabilities to use ICT products and services;
- *Information literate* - The web site – <http://www.ala.org/acrl/ilintro.html>) describes the information literate as an individual with ability to:-
 - “determine the extent of information needed;
 - access the needed information effectively and efficiently;
 - evaluate information and its sources critically;
 - incorporate selected information into one’s knowledge base;
 - use information effectively to accomplish a specific purpose;
 - understand the economic, legal and social issues surrounding the use of information and access and use information ethically and legally”

vii) KNOWLEDGE ACCULTURATION

As the term Knowledge Acculturation⁹ connotes, knowledge acculturation involves a process of getting adapted to data preparation and culture of information handling and usage to create wealth.

viii) INFORMATION SOCIETY

Information Society is defined as a society comprising of individuals and organization (including public, private and non-profit sectors) with the following characteristics:-

- possess connectivity of networks – human, infrastructure and virtual ;
- use on line connectivity and real time interactivity products and services for information;
- exercise culture of learning;
- have equitable access to information – within and across geographical boundaries;
- possess ICT literacy;
- have information literacy;
- able to use database to accomplish a specific task

(Source: Modified version from NITA Strategy for E-Malaysia)

ix) KNOWLEDGE SOCIETY

Knowledge society is defined as a society constituting individuals and organizations with the following characteristics:-

- possess all the characteristics of information society; information society is a prerequisite step towards formation of knowledge society
- has the ability to convert or manipulate data and information to knowledge;

⁹ Acculturation defined as the process of becoming adapted to new or different culture with more advanced patterns

- treat data, information and knowledge as a commodity or as one of the factors of production besides using land, labour, capital and technology;
- creative and innovative in adding values to existing products and services by utilizing created knowledge;
- creative and innovative in inventing new knowledge products and services;
- inclusive society;
- socially and economically empowered
- self regulated and self controlled

x) DATA WORKER

A data worker has the following characteristics:-

- an employer or employee or own account worker or unpaid family worker *irrespective of age; - (on contrary to traditional labour force age group 15 -64);*
- does work for pay, profit or family gain;
- ICT literate;
- has the ability to perform data collection and data preparation activities, which include activities such as coding, editing, data entry and validation.
- *e.g a console operator performing data entry work in a main frame environment*

xi) “NETWORKED” INFORMATION WORKER

An Information workers has the following characteristics:-

- an employer or employee or own account worker or unpaid family worker irrespective of age;
- does work for pay, profit or family gain;
- ICT literate;
- Information literate – has basic skills and capabilities to prepare data, process and distribute information.
- *e.g. a bank clerk using a customer database to perform a banking transaction*

xi) “NETWORKED” KNOWLEDGE WORKER

A Knowledge worker is a worker who is characterized by the following:-

- has all the characteristics of an information worker ;
- uses data and information to create knowledge ;
- uses knowledge to innovate new products and services;
- involves in value creation activities;
- adds social and economic values to products and services at work or play;
- empowered and self regulated;
- *e.g. a bank clerk using a customer database for a banking transaction*

4. CONCLUSION

The paper basically depicts only a preliminary work on developing information age statistics for official use. Most of the concepts and definitions mentioned above are still in theoretical mode. However, the Internet Subscriber Study (2001), INFOSOC Exhibition Visitor Study and MMA Exhibition Study have been used as a platform to test the workability of the some concepts and definitions pertaining to Information and Communication products and services. The Eight Malaysia Plan (2001-2005) provides the requisite policy strategy and resources in carrying out the research on ‘soft factors’ on information age developments.

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