Chapter 1: Introduction to the Thesis

(for thesis of Ranjit Goswami, titled *'From e-business to social tool for the poor – a study on Internet applications, drivers and impact'*)

1.1 Introduction

This chapter gives the background, the problem area as it evolved with various perspectives, applications and drivers of use of Internet in society, and thereby impact of Internet on society.

Research questions emerged out of these diverse perspectives of Internet applications, their drivers and their critical impact on society. This chapter also deals with the structure of subsequent chapters of this thesis. This chapter establishes the common linkage across the subsequent chapters dealing with the on applications and drivers to gain insight on the impact of Internet applications on society.

1.2 Definitions of Key Terms

1.2.1 Internet

The origins of the Internet could be traced to the ARPANET (Advanced Research Projects Agency Network), of the U.S. Department of Defense in 1969. Federal Networking Council (1995) defined "Internet" as:

> A global information system that -
>
> 1. is logically linked together by a globally unique address space based on the Internet Protocol (IP) or its subsequent extensions/follow-ons;
> 2. is able to support communications using the Transmission Control Protocol/Internet Protocol (TCP/IP) suite or its subsequent extensions/follow-ons, and/or other IP-compatible protocols; and
> 3. provides, uses or makes accessible, either publicly or privately, high level services layered on the communications and related infrastructure described herein.

Following above, one can say the Internet is a subset of the global information system. Ciborra (2002) defined information systems as the area that deals with the deployment of information technology for the sake of collecting, processing, storing, retrieving and disseminating information in organizations, institutions, and society at large.

Two more definitions of Internet are given below:

internet (Lower case "i"nternet): Pcmag.com (Pcmag.com on Internet definition, accessed in 2008) defined (and differentiated 'internet' from 'Internet') as a large network made up of a

number of smaller networks. Although still a majority uses capital 'I' for Internet, many inadvertently use small lower case 'i' to mean the same Internet.

"I"nternet (Upper case): The largest network in the world. It is made up of more than 350 million computers in more than 100 countries covering commercial, academic and government endeavors. Originally developed for the U.S. military, the Internet became widely used for academic and commercial research with real time information dissemination capabilities.

The Internet, sometimes called simply "the Net," is a worldwide system of computer networks (extending to telecom networks as well due to digital convergence) - a network of networks in which users at any one computer (or compatible handheld device) can, if they have permission, get information (and interact) from any other computer (device) (Whatis.com on Internet definition, accessed in 2008). The TCP/IP protocol is used in the Internet.

1.2.2 Internet Applications

Internet applications have been considered from users' perspectives than from technical perspectives or technological advancements (Amichai-Hamburger, 2001). Different protocols use Internet technology to deliver end-services, however we focused on end-services than on the protocols or technicalities that run as applications on Internet technologies. The focus of the thesis was on applications, having highest social relevance, from the perspective of diverse user-groups. The categories of Internet applications, as a General Purpose Technology (GPT) (Guerrieri and Padoan, 2007) or as an infrastructure, (Palvia, 1997) encompassed almost all spheres of life, from its applications as a source of competitive advantage in business organizations (Porter, 2001) to its social developmental roles for building human capital in developing nations (Madon, 2000). This thesis developed a framework **(Figure 1.4)** with four major categories of Internet applications (and two drivers) from the view-point of major categories of users of Internet.

1.2.2.1 Drivers of Internet Applications

Drivers of socially relevant Internet applications are like the translator between non-technical user groups and the technologies (technical applications or program groups behind Internet). Most users need an enabler, an interface, an entry point, or a gatekeeper to use and educate

themselves about categories of Internet applications suitable for them (Chanson, 1998). Each General Purpose Technology (GPT, defined later with ICTs) like Internet has its own set of specialized commands, rules, and technicalities where drivers help users access this technology with generic or user-friendly commands. The driver converts generic commands and translates them into specialized commands for the vast majority of Internet users who are unaware of the intricacies and complexities of Internet technology and tools. These drivers can therefore be applications of Internet as well, however irrespective of categories of end-user applications or user-groups, all users apply these drivers that further enhance Internet usage.

1.2.3 Digital Convergence

Digital convergence led by Internet, and as a driver of further Internet applications and usage, was an area where text, voice, data, picture, moving video, audio and all forms of communicating media merged over the same network, and thereby could be accessed from a common, even low-cost device. In simple terms, '*convergence is* (was) *the process by which mediums such as TV, cellular networks and internet-based applications are drawn together or networked'* (Motive Glossary on definition of convergence*, accessed in 2008)* whereas its technical definition meant *'trends for various information and communications technologies to become digital, and it can refer to the trend for communications technologies to be based on packet switching and operate over a common network infrastructure'* (Linux information project on definition of convergence, accessed in 2008). International Engineering Consortium (IEC on coming of true convergence, accessed in 2008) defined convergence in a straightforward manner as:

'In a converged network environment, a user's voice network should work in the same manner as his or her data network and vice versa. In other words, the way a user performs actions with familiar tools in the data world should not change as voice services are added into an Internet Protocol (IP) or Asynchronous Transfer Mode (ATM) network.'

Digital convergence is expected to further extend the reach of Internet and its applications to people not owning or having computers, and having even low-cost mobile devices. The need for convergence emerged from the concept of a single integrated common carrier from technological integration of print, telecommunications and broadcasting systems with firm-level integration of

publishers, telephone companies, cable TV operators, and broadcasters (Pool, 1983). Mueller (1999) highlighted that in spite of the concept of convergence coming in-and-out of fashion for nearly three decades, why several of the messiah technologies had been crucified, and thereby failed to deliver whereas the TCP/IP based Internet had the promise to ultimately deliver.

1.2.4 Disruptive Technology

Disruptive technology (or disruptive innovation), a term coined by Bower and Christensen (1995) incidentally meant a new, low-cost, and often simpler technology (innovation, product or service) that displaces an existing dominant technology or status quo of existing market with 'disruptive' strategy (rather than 'revolutionary' or 'sustaining' strategy). Internet itself is a massive disruptive technology (Lyytinen and Rose, 2003), and it further developed an atmosphere of innovation for lot many more disruptive products and services to emerge. However the way it happens is interesting due to the uncertainties (Christensen, 1997) it presented to practitioners and policy-makers. In the context of this thesis, Internet applications lead to unresolved examples of more disruptive technologies due to the design process of Internet itself (Soudoplatoff, 2006) (like Voice over Internet Protocol – VoIP – an area studied in this thesis, or e-books, or Napster or Apple iPhone for music industry, etc). Even if many of these technologies turn out to be incrementally developing, Hacklin et al. (2005) in their research presented how the convergence of several well-known, incrementally developing technologies can result in innovations with highly disruptive character in terms of innovation trajectories.

1.2.5 Information Technology (IT)

The Information Technology Association of America (Wikipedia, accessed in 2008), defined IT as *'the study, design, development, implementation, support or management of computer-based information systems, particularly software applications and computer hardware'*.

1.2.6 Information and Communication Technologies (ICTs)

'ICT (information and communications technology - or technologies) is an umbrella term that includes any communication device or application, encompassing: radio, television, cellular phones, computer and network hardware and software, satellite systems and so on, as well as the various services and applications associated with them, such as videoconferencing and distance learning' (Whatis.com on ICT, accessed in 2008).

Maltzahn (2005) defined '*ICTs in terms of three interlinked categories: information technology using computers, telecommunication technologies such as the telephone/fax and radio and*

television broadcasting, and networking technologies, ranging from the, internet to mobile phones, Voice over IP telephony, (VOIP), satellite communications, and more.'

While exploring Internet and Information Technology, Rosnay (2000) stated that Internet is not a part of information technology; it is more of a relationship technology. Rosnay (2000) felt that the Internet is now a complex informational ecosystem, and this thesis considers Information Technology and Internet as General Purpose Technologies (GPTs) under the broader framework of ICTs. ICTs are actually *'a convergence of technologies—the personal computer, software, the Internet, and broadband and wireless communications, among others — is not only integrating international commerce; it is changing the internal practices of business'* (Bollier, 2005). Lipsey et al. (1998) opined that GPTs have features like wide scope for improvement and elaboration, applicability across a broad range of uses, potential for use in a wide variety of products and processes, and strong complementarities with existing or potential new technologies.

1.2.7 World Wide Web (WWW)

The World Wide Web or simply the Web is defined as the complete set of documents residing on all Internet servers that use the HTTP protocol, accessible to users via a simple point-and-click system (Answers.com on WWW, accessed in 2008).

The relationship between these two, i.e. the Internet and the World Wide Web is something rooted in their beginning. In the words of Bill Gates (2000), while *'the Internet was an obscure network of large computers used only by a small community of researchers'* that preceded the Web, *'the "killer application"* that transformed the Internet into a global phenomenon was the World Wide Web. Developed in 1989 at the European Center for Nuclear Research (CERN), the Web was initially created to share data on nuclear physics (Berners-Lee and Fischetti, 1999). By using hyperlinks and graphical *'browsing'* technology, the Web greatly simplified the process of searching, accessing, and sharing information on the Internet, making it much more accessible to a non-technical audience.

The difference between these two terms (Web and Internet) is given with clarity in Answers.com (on Web vs. Internet, accessed in 2008) that non-technical users can follow as:

'Content vs. Transport. Many people use the terms Web and Internet synonymously. In casual conversation such as "I was on the Internet" or "I was on the Web," there is no difference. However, in fact, the Web is just one of the services deployed on the Internet. Just as cargo is

transported by a truck on a highway, a Web page is transported by packets on the Internet. When information is sent over the Internet, it is broken apart and packaged inside Internet Protocol packets or "IP packets"'.

The World Wide Web (WWW) is one of the many services accessible via the Internet, along with various other services including e-mail, file sharing, online gaming, etc.

1.3 IT and Internet as General Purpose Technologies (GPTs)

The current era is often termed as the information era. Lyman and Varian (2003) showed that the world's total production of information amounted to about 250 megabytes for each man, woman, and child on earth per year for 2002 **(Table 1.1)**. Lyman and Varian (2003) thereby concluded that the obvious challenge therefore was to learn how to swim in that sea of information, rather than drowning in it. Horn (2006) on the same topic asked *'How do we make all this information more useful?'* The challenge essentially was to make rapidly growing amount of qualitative and quantitative information more useful by developing applications for as many users as possible.

Storage Medium	2002 Terabytes Upper Estimate	2002 Terabytes Lower Estimate	1999-2000 Upper Estimate	1999-2000 Lower Estimate	% Change Upper Estimates
Paper	1,634	327	1,200	240	36%
Film	420,254	76,69	431,690	58,209	-3%
Magnetic	5187130	3,416,230	2,779,760	2,073,760	87%
Optical	103	51	81	29	28%
TOTAL:	**5,609,121**	**3,416,281**	**3,212,731**	**2,132,238**	**74.5%**

Table 1.1: Worldwide production of original information, if stored digitally, in terabytes circa 2002. Upper estimates assume information is digitally scanned, lower estimates assume digital content has been compressed.

Source: Lyman, How much information 2003

Information Technology (Porter and Miller, 1985), and subsequently Internet (Porter, 2001) have been viewed as a source of competitive advantage for business organizations. UN Publications (2001) found role of IT and Internet in sustainable development of human capital; and Madon

(2000) found stronger role of IT and Internet in development of human capital in the developing nations. This developmental role of human capital included forms of creating and nurturing a knowledge society. Eventually, IT and Internet were categorized as much-needed commoditized technology (Carr, 2003) and as General Purpose Technologies (GPTs) (Lipsey et al., 1998). However, while characterizing common attributes of GPTs, following four features of GPTs emerged (Lipsey et al., 1998):

1. Applicability across a broad range of uses;
2. Potential for use in a wide variety of products and processes;
3. Strong complementarities with existing or potential new technologies; and
4. Wide scope for improvement and elaboration.

Adaptation of General Purpose Technologies (GPTs) also results in improved economic productivity growth (David and Wright, 1999), thereby having larger impact on society as well.

1.4 Growth and Convergence of ICTs

The seminal work Shannon (1948) defined information and subsequently led to the generation of the field of study called *'Information Theory'*. However, it was more of a mathematical way of looking at information with the measure of information being in bits. This has been continued through the study of Lyman (2000) (and subsequently Lyman and Varian, 2003) half-a-century later. The seminal paper of Shannon (1948) laid out the basic elements of digital communication networks with its pioneering focus from its source through its transmission, channel, receiver and finally to the intended destination. This thesis is more interested in the nature of the definition that made the information flow through Internet relevant and complete in the context of applications and impact. The thesis took the whole loop of information flow backward from Shannon's viewpoint – starting from the destination, i.e. from the applications of that information sharing or communicating over Internet platform for the users and moving backward to determine which applications are likely to have the largest impact on society.

Barring the human interface part as destination, qualitative impact of information on people and on broader human society was largely ignored in Shannon's (1948) concept of information. As

per Shannon (1948), information was confined to one particular aspect of transmission and storage. This led to the formation of *'Information theory'* - a branch of applied mathematics and engineering involving the quantification of information. What followed next was the rapid transition towards a *'digital economy'* through convergence and a set of innovations spanning computing, physical layer of telecommunication and also through networking (Internet through Packet Switching). Ayres and Williams (2004) opined that computing as a function and computers as an industry made rapid progress through semiconductor transistor, integrated circuit, personal computers (PCs), operating systems, and graphical interfaces; the physical layer of telecommunication was enabled via the emergence of optical fiber and new wireless communication technologies; whereas networking saw the development of the Internet (essentially packet switching) and the World Wide Web. This thesis explores the impact of access of information through various ICTs, primarily driven by Internet and digital convergence, on human society.

The structure of the computer industry in-between went from vertical industry structure with integrated modular product architecture, dominated by IBM (**Figure 1.1**) to a horizontal industry structure (**Figure 1.2**) with modular architecture (Farrel et al., 1998). Emerging through concepts such as Internet-centric cloud computing (Vaquero, 2008), the industry structure may be undergoing another change back to the vertical industry structure with latest round of consolidations as seen within the industry.

The other significant milestone development that must also be mentioned is the evolution and subsequent rapid growth of mobile phones, the fastest for any technology (Vetter and Creech, 2008) and thereby having the highest penetration on broader society. Through digital convergence driven by Internet and accessible in more and more mobile devices, a large section of underprivileged people in future may have their first access point of Internet through less costly mobile phones than through any forms of computers. Consolidation and innovations in telecom industry followed trend of IT industry in value chain, costs and in industry structure (particularly in mobile industry with Apple iPhone, Blackberry of RIM or Google's ongoing product launches in mobile telephony with Android mobile operating software and Nexus One Phones).

The world has been going through an information and communication revolution. Business organizations, most adept in managing information efficiently, were the early adopters to above changes in IT, Internet and overall ICTs. Stages of Growth Model (Gibson and Nolan, 1974), a widely referred model on adoption of information systems, represented the irregular pattern of an Electronic Data Processing (EDP) system's development (EDP being one of the earlier information systems in place in large organizations in the 1970s).

Figure 1.1: Computer Industry Structure: 1975-1985 (Source: Farrell et al., 1998)

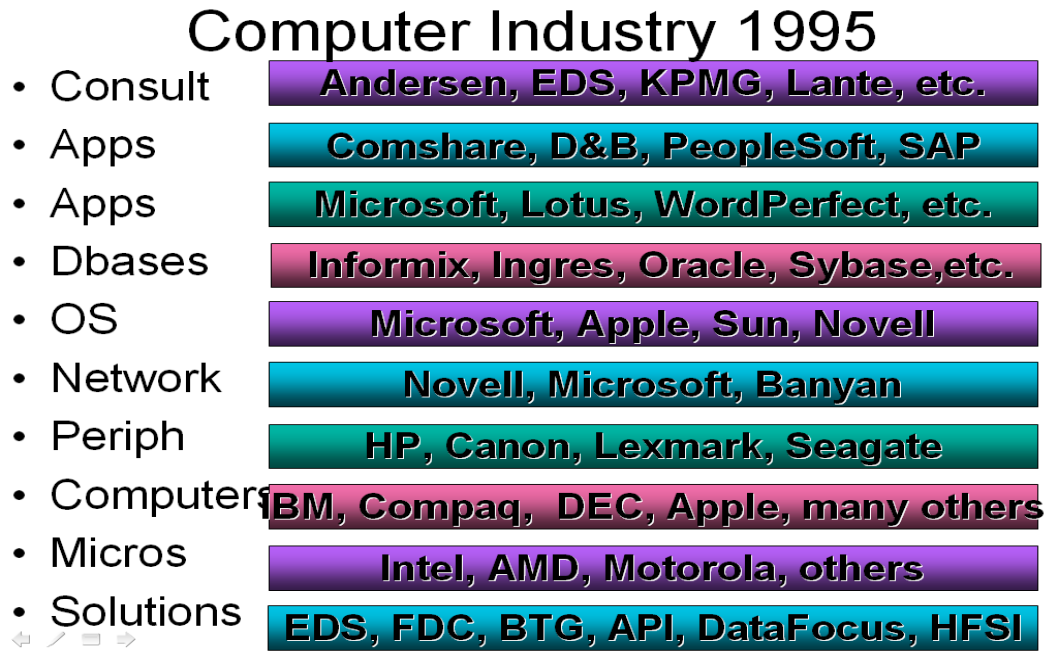

Figure 1.2: Computer Industry Structure in 1995 (Source: Farrell et al., 1998).

Information and Communication Technologies (ICTs) subsequently have undergone through a sea-change due to massive innovations in software, hardware and in networking and telecom capacities and also due to digital convergence, at the core of which remain Internet. A look at few numbers globally and locally, in terms of the growth of Personal Computers (PCs), mobile phones and Internet-subscriber growth highlight this gigantic shift in the information and communication revolution. Back in 1975, global sales of PCs were estimated to be 2000 (Reimer, 2005), which in 2008 was estimated to be at 287.8 millions (IDC, 2006). Interesting thing to note, in the background of this thesis is, more than 50% of PC sales were under commercial category (business usage). With around 61% of global PC sales coming under commercial category, marginally lower than in 2004 (62.4%), business organizations took the lead over individual consumers.

In the local context, PC sales in India grew from 1.4 million in 1999-2000 to 5.4 millions in 2006-07 (Sinha, 2007). In 1999-2000 global sales of PCs was around 130 millions (Reimer,

2005) which was estimated to grow to 287.8 millions by 2008 (IDC, 2006). So during the last few years, India (or other developing world, expectedly) grew at almost twice the global rate.

The mobile telephone subscriber growth has been even more phenomenal in the recent times. Mobile telephone subscribers/100 inhabitants globally grew from 1 in 1994 to 27.4 in 2004 to more than 50 in 2009, whereas corresponding figures for developed world were 5.2 to 76.8 to nearly at saturation levels, and for developing world these figures were 0.19 to 18.0 to again more than 50. In more recent times, the world has seen much faster growth in the developing nations, more so with rapid growth in mobile subscribers in China and India, with subscriber base of more than 0.7 billion and 0.5 billion respectively. Driven by digital convergence, King (2010), quoting from a Gartner report, predicted that by 2010, smartphone sales may outnumber that of personal computers.

A similar trend is also observed in matters of growth in Internet subscribers. Starting from December, 1995 when it was merely 0.4% of global population, in December, 2007 it reached 20%, and by 2009 it was at 24%. So it started with a lower base than mobile subscribers, and peaked fast; however lately mobile subscriber base has again increased much faster than Internet subscriber base. The other important thing to note here is many of these technologies have wider penetration amongst younger generations, and research has already shown that within segments (like the youth (Stone, 2007)) or in developed countries like the U.S.A (eMarketer, 2010)) people are more time online compared to their other media consumption trends;. **Figure 1.3** compares the growth within the ICTs.

This tremendous growth in users led to the growth in commerce, in online advertisements and in number of web-pages; but its impact was most prominent on how people consumed or even created media, and thereby on the media industry (Rusbridger, 2010). Online retail sales (excluding tickets and travel expenses) in the US was estimated to be around $ 204 billion in 2008, a growth of 17% against overall retail sales growth of around 3.5% (Rosencrance, 2008), whereas ASSOCHAM (eBay India forum, 2007 citing ASSOCHAM) estimated that e-commerce market size in India in 2007-08 to be around Rs. 5500 crores (around $1.35 billion). Online advertisements grew phenomenally, fueling a growth in number of web-pages as well. Balmer of

Microsoft (2008) expected online ad-industry to grow from $40 billions to $ 80 billions over next three years from 2008 as he explained his reasons to bid for Yahoo!. Number of web-pages per Internet user also grew to 70 in 2007 with more additions in web with time (Internet Archive, 2007).

All these numbers highlighted this evolution which started in different forms but all having its impact felt over last couple of decades – call it the IT revolution, the PC revolution, the mobile revolution or ultimately the Internet revolution. This evolution has been characterized by falling prices with better features of ICT products, known popularly as the Moore's law (Moore, 1965). Along with growth in PCs and in mobiles or in Internet users; there also emerged the trend digital convergence, which essentially meant coming together of three main technologies, i.e. computer, telecommunication and media.

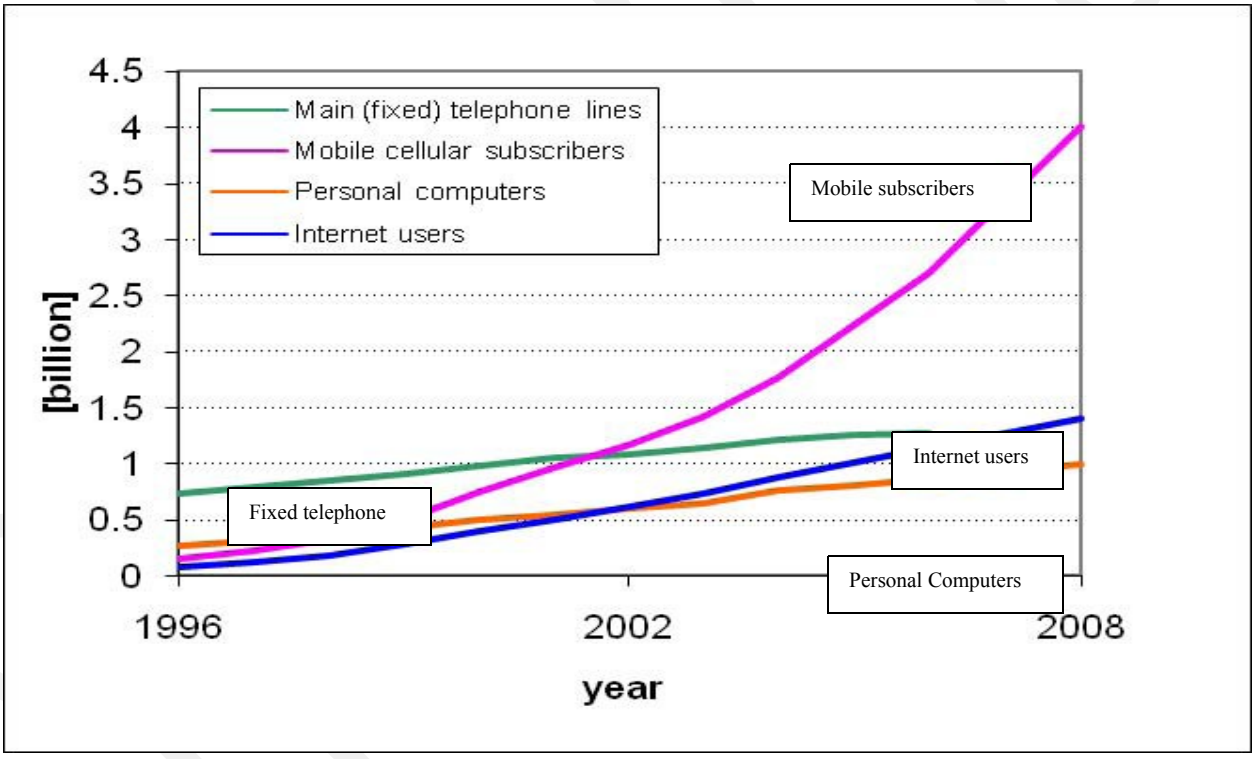

Figure 1.3: Comparison of growth of ICTs[1] in the world (Source: Vetter and Creech, 2008)

There have been quite a few Internet-based applications, already tried out or at various stages of developments, to have a seamless convergence between telecom and Internet. Voice over

[1] Source: Key Global Telecom Indicators for the World Telecommunication Service Sector, http://www.itu.int/ITUD/ ict/statistics/at_glance/KeyTelecom99.html and supplemented with data from Gartner and Yankee Group (by Vetter and Creech (2008)).

Internet Protocol (VoIP) showed the promise that could boast of real convergence between the Internet and the telecom sector; however it failed to deliver as it may yet to mature. It resulted in success in this area not being comparable with the convergence of Internet (Net-Computer) with the media. There has already been a host of Internet-applications on handheld devices and on mobile phones, and at the same time, a plethora of current developments in this area highlighted the potential of convergence of Internet applications over the mobile communication networks.

Therefore with converging technologies over the common Internet platform already achieved, the present age happened to be in the threshold of an era of digital revolution, where irrespective of the device or platform, the core is increasingly being transferred to Internet or Internet-supported services. In spite of the huge growth in overall ICT evolutions and their penetrations in all measures, a significant number of people, more so from developing countries and from underprivileged sections, remained unconnected to the ICTs world – more to higher-order ICTs value chain like Internet. Digital divide raised further challenges for policy-makers; however with falling prices and improved coverage, a reversal trend of digital divide is observed (Fink and Kenny, 2003), particularly in mobile connectivity. Due to the characteristics of these new technologies and applications, there was optimism that ICTs could be used like never before for the benefit of the poorer section of the society.

At the same time, newer challenges too emerged out of this tremendous growth in usage and their potential benefits. Internet due to its characteristics is global in nature; however laws that regulate online media are country-specific (Morozov, 2009). Internet can act as an uncensored source of information for causes of human rights; however the interpretation of it may lead to differences as same uncensored information can cause damage to the society. The above developments led to the dispute between Google and China in 2010, following which Google decided to exit China (Drummond, 2010). As the power of Internet (as a soft power) grows in terms of influencing public opinion, a dispute having the magnitude involving Google as an Internet search giant and China as the largest Internet-user base can split society (Wines, 2010; Rein, 2010 for view from the Chinese side), and can lead to cold-war mentality with cyberwar (Sanger, 2010), where leading nations may try controlling Internet for country-specific interests.

1.5 The Internet: Evolution and Emerging Trends

It was in 1962 when Leonard Kleinrock, a doctoral student at MIT, wrote a thesis describing queuing networks and the underlying principles of packet switching technology that the first foundation for modern day Internet was laid. In those days, there were serious concerns in the US military of the possible fallouts of any accidental breakdown of telecom links. Engineers working under Advanced Research Projects Agency (ARPA) of the U.S. Department of Defense designed a *"network of networks",* nicknamed ARPANET. Initially four computers were hooked up. No one could have foreseen the eventual explosion in growth. By the 1970's, rules and standards (protocols in computers) were being developed for transferring data between the various types of computers **(Table 1.2).**

The term *'Internet'* emerged in 1983 for the network of networks. It grew at a phenomenal rate, with universities, governments, and research institutions actively participating in the expansion. The domain name service (DNS) was launched in the following year by Paul Mockapetris and Craig Partridge. Its advent eased the identification and location of computers connected to ARPANET by linking IP numerical addresses to names with suffixes such as .mil, .com, .org. Subsequently, the World Wide Web software was developed by Tim Berners-Lee in 1991. By the end of the 20th century the Internet embraced some 300,000 networks stretching across the planet. The communication infrastructure involved optical fibers, cable television lines, radio waves as well as telephone lines. Vinton Cerf, one of the principal designers of Internet, remarked: *'Revolutions like this don't come along very often'* (National Academy of Engineering, accessed in 2006).

According to a report of Internet World Stats as on March 31, 2006, Internet had penetrated 15.7% of the world population with usage growth rate of 183.4% from 2000 to 2005 **(Table 1.3).** One of the major reasons for the popularity of the Internet as a global medium was its decentralized structure. Internet had taken the shape of a virtual community owned by none. It empowered individuals and organizations easy and equal access to billions of web pages apart from the opportunity to communicate with hundreds of millions of internet users. Low barriers to entry, relatively small capital expenditures and electronic payment technologies enabled

merchants to display their products to a worldwide population of consumers regardless of geography, language or currency.

Year	Milestones
1962	Kleinrock thesis describes underlying principles of packet-switching technology
1966	ARPANET project
1967	Donald Davies, of the National Physical Laboratory in Middlesex, England, coins the term packet switching to describe the lab's experimental data transmission.
1970	Initial ARPANET host-to-host protocol UNIX operating system
1972	First e-mail program
1972	First public demonstration of the new network technology
1973	Paper describes basic design of the Internet and TCP
1975	TCP/IP incorporated
1977	Demonstration of independent networks to communicate
1979	Internet Configuration Control Board
1980	TCP/IP standard adopted
1983	UNIX scientific workstation introduced Internet Activities Advisory Board The Internet
1984	Advent of Domain Name Service
1987	Internet of administratively independent connected TCP/IP networks emerges
1989	Interconnection of commercial and federal networks
1991	World Wide Web software developed
1992	Internet Society is formed
1993	Distribution of a browser accelerates adoption of the web Network Solutions manages domain names
1996	Telecommunications Act of 1996
1998	Coordination of Internet domain names transitions from federal to private sector
*2009	Domain names in non-Latin languages

Table 1.2: Internet Milestones

Source: Internet Timeline, http://www.greatachievements.org/?id=3736, as on 10th May, 2007.
** - Updates since 2007 (Oslen, 2009)*

DATE	NUMBER OF USERS	% WORLD POPULATION
December, 1995	16 millions	0.4 %
December, 1996	36 millions	0.9 %
December, 1997	70 millions	1.7 %
December, 1998	147 millions	3.6 %
December, 2000	451 millions	7.4 %
August, 2001	513 millions	8.6 %
September, 2002	587 millions	9.4 %
September, 2003	677 millions	10.6 %
December, 2004	817 millions	12.7 %
December, 2005	1,018 millions	15.7 %
December, 2006	1,093 millions	16.7 %
December, 2007	1, 319 million	20.0%
December, 2008	1,574 millions	23.5%
June, 2009	1, 669 millions	24.7%
December, 2009	1,802 millions	26.6%

Table 1.3: Internet Statistics on User Growths

Source: http://www.internetworldstats.com/emarketing.htm on 8th April, 2010

The rise of the digital media, ubiquitous communication, citizen journalism and blogs, convergence which we covered as another driver of various Internet applications, local/geographical web search (Google earth, Wikimapia), the digital anarchy as presented by various new-age dotcoms targeting at specific segments and applications, the uncertainties related to network neutrality, and the nemesis of a behemoth of Microsoft – all of these play significant role in determining the future trends of Internet applications along with how soon these applications reach their matured levels and their likely impact on various categories of users.

1.6 Need and Objective of the Current Piece of Research

Internet, as a General Purpose Technology (GPT) (Guerrieri and Padoan, 2007) or as an infrastructure (Palvia, 1997), is applied in almost all spheres of life, from its applications as a source of competitive advantage in business organizations (Porter, 2001) to its social developmental roles for building human capital in developing nations (Madon, 2000). Bill Gates (2000) equaled Internet and its long term impact on society with the impact equivalent of sum of electricity, telecom and automobile put together on society. However, due to the rapid evolutions

that Internet has seen and innovations it has facilitated (Wolcott et al., 2001) and also due to the disruptive nature (Christensen, 1997) of those innovations, it has been difficult to study (Lyman, 2000) and categorize Internet applications and their drivers holistically.

The complexity, rapid growth, and pervasive applications of Internet made it difficult for academicians, practitioners and policy-makers to understand, analyze and plan for the most critical impact of Internet on society (Nie and Erbring, 2000). It was also difficult to holistically study applications and drivers of Internet, and thereby gauge an overall sense of potential benefits from Internet (Zimmerman et al., 2001). Therefore, the objective of this study was to look for key categories of Internet applications and their drivers (Section 1.6) in order to identify the critical interventions of the Internet (Figure 1.4) for delivering significant benefits to human society. The objective of identifying these critical interventions of Internet on society was to find area/areas of critical impact of Internet on society. The research questions originating from the sub-objectives of Internet applications and drivers further get explained in **Section 1.10**.

1.7 Classification of Internet Applications and Drivers

The Internet topology has been continuously evolving with new applications and drivers and user experiences/participations with rapidly increasing number of users using Internet more often for established or for newer applications. Drawing from Kingston (2007), in this thesis, Internet applications meant studying simultaneously, in a holistic manner, number of socially most relevant applications of Internet from diverse user-groups' perspectives and identifying generic drivers of these applications to gauge the potential benefits holistically and most critical impact of Internet on society.

Internet is considered as an infrastructure (Palvia, 1997), and a GPT (Lipsey et al., 1998) and therefore it finds its applications in almost all spheres of lives and human civilization. However following the complexity of evolution of IT, due to the rapid development of Internet – the examination of its applications and their drivers, along with potential benefits from Internet applications have not been fully examined or understood (Zimmerman et. al., 2001). It is difficult due to quality of data (Lyman, 2000) when one examines whole of Internet, including the billions of web-pages in the WWW. Subsequent studies covered parts of that (Brousseau and

Curien, 2007); however those again had their limitations by focusing more at certain types of application/s rather than examining the whole universe of applications and drivers and thereby classifying them in key categories of applications and drivers of these applications.

At the same time, the application of Internet is limited by our imagination only (Chanson, 1998). Classifying Internet applications therefore is not an easy task. Literature was available on various categories of applications (e-business, e-governance, social development for underprivileged, individual usage of Internet and so forth) but most focused on a particular category of application than on classifying application categories. The same challenge existed for the drivers as well.

DiMaggio et al. (2001) identified five key areas of research interests on Internet applications including (1) inequality, (2) community and social capital, (3) political participation, (4) organizations and other economic institutions, and (5) cultural participation and cultural diversity. Chanson (1998) identified five of the critical enabling technologies (which have been termed as drivers of Internet applications in this thesis) that influenced Internet usages as (1) web-browsers, (2) search and indexing engines, (3) security features, (4) authentication techniques and (5) multi-media applications (equivalent to what this thesis identified as digital convergence in a broad sense).

1.7.1 Problem Areas of Internet: Hurdles towards Various Online Applications

New technologies generate new opportunities for crime (Grabosky, 1998). Internet as a powerful, pervasive, disruptive GPT has also generated enormous concerns about legitimate issues of its usage. Even the question of *'Legitimacy'* confounds the regulators, policy-makers and law-makers as they constantly and continuously figure out comprehensive implications of many of the Internet applications on unsuspecting users' lives (Geist, 1998). The major problem areas that have developed along with wider penetration of Internet and its various applications are in the areas of privacy, security and fraud. The need to find effective solutions to these problems has also driven a lot of innovations; an example of it can be with the case of RSA algorithm (Rivest et al., 1978) or subsequent work on it, for security issues. Effectively this has resulted in a race where new concerns emerge and potential solutions, through innovations or policy-measures follow. One recent example of that concern has been WikiLeaks, and how it

gets viewed – as a positive or as a negative (Clayton et al., 2010). However while examining the various applications and impact of Internet in this thesis, impact of these concern areas and its downside impact has not been included in the scope of the thesis.

1.8 Framework of Classification of Applications and Drivers in This Thesis

Taking leads from classifications of Internet applications (DiMaggio et al., 2001) and their drivers (Chanson, 1998), this thesis developed its own classification of Internet applications (for major areas of usage) and their drivers in **Figure 1.4**. This framework identifies four application areas as (1) business applications (BA), (2) applications in government (GA), (3) individual or personal applications (PA) and (4) applications as a social tool for the benefit of the poor (SA), and two drivers as (1) digital convergence (DC) and (2) search engines (SE)[2] across all categories of applications.

Due to complexities similar to IT, Zachman's framework (accessed in 2008) of multi-perspective modeling to describe, design and build complex objects was followed (who, what, when, where why and how covering applications, drivers and impact). Unlike an IT system, there were limitations in applying Zachman's framework (1987) in the area of Internet because of lack of clear ownership, builder or designer for the Internet-driven applications.

Shan and Hua (2007) suggested a holistic approach similar to above framework highlighting the drawback of Zachman's framework (1987) as Zachman essentially had a data-driven approach with process-decomposition method. However all these frameworks had another perspective totally different from ours – they all viewed complex systems with the mindset of technical perspectives and on its architecture rather than on its various users, applications and impact. The focus for framework in **Figure 1.4** was on diverse user-groups' needs and its fulfillments – achieved and promised, through critical applications, than on technological advancements (Amichai-Hamburger, 2001).

[2] *'Search',* in itself, can also be considered as a huge application area of Internet. However as *'Search'* is used across usage categories by diverse groups of users; and also due to its applications over diverse accessing devices; this thesis considered 'Search' to be a driver of all applications areas of Internet.

There were others too who wanted to have a similar simplified understanding of this otherwise complex phenomena of Internet applications, its drivers and impact on society. Cellary and Arun (2002) looked at it more from individual usage and societal impact with convergence angles.

Following **Figure 1.4** of Internet perspectives, the thesis developed **Table 1.4** on proposed framework for Internet applications from the perspective of its different user groups following Zachman's framework of six basic, fundamental questions (what, how, where, who, when, why in terms of Internet usage). Due to inter-related nature of the applications, drivers and also due to the rapid pace of evolutions; circular research methodology (Glaser and Strauss, 1967) in broader line with grounded theory of qualitative research methods (generation of theory from data) was followed in answering these questions.

1.9 Defining the Scope within the Framework of the Thesis

Business applications of the Internet covered web-based applications like e-business, e-commerce, and other collaborative applications spanning the end-to-end supply chains. A new breed of firms (dot-coms) emerged with the Internet, and this lot experimented with various business models, many succeeded but many failed too (Goldfarb et al., 2007). In the early phase, it did lead to a hyped categorization between new-economy players (so called Internet or pure play or online 'click' companies) and that of old-economy players (the brick and mortar physical firms).

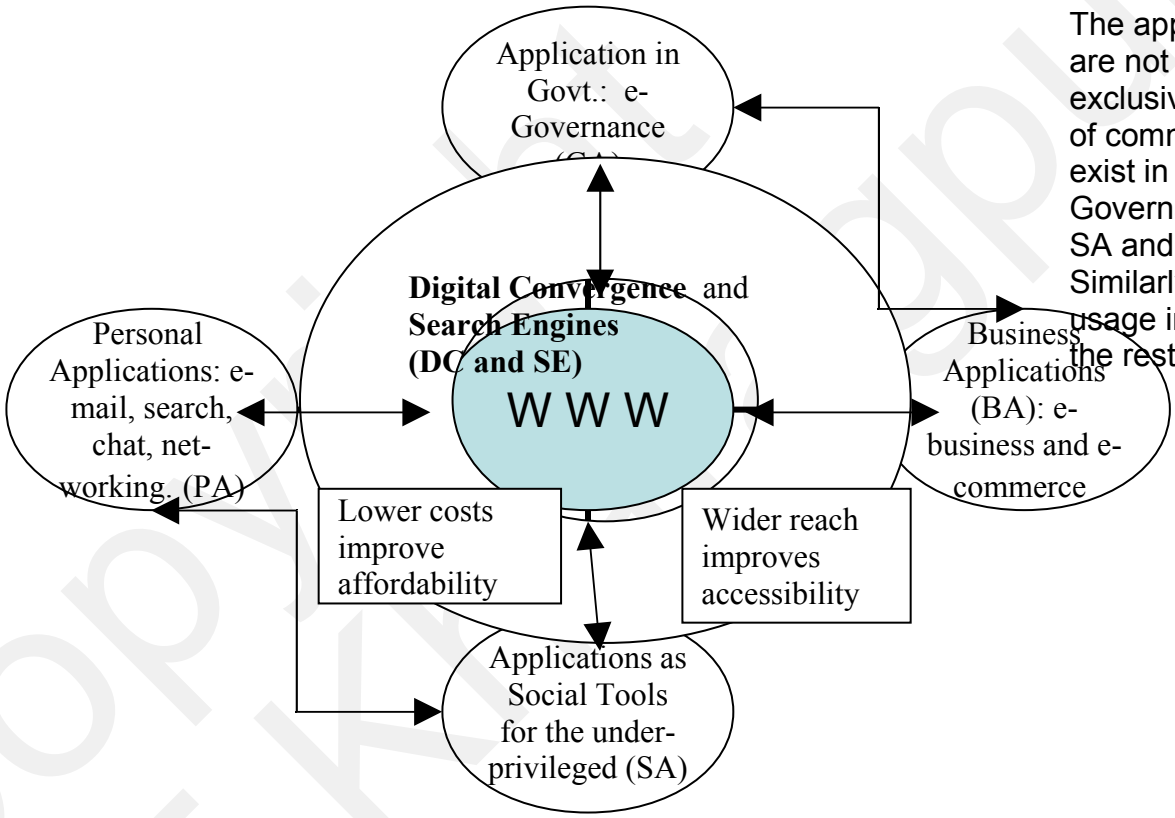

Figure 1.4: Categories of Internet Applications and Drivers (the framework followed in this thesis)

New-economy players were the early adopters as their business model centered on Internet itself. However with time, this distinction was only on paper, as Andy Grove observed[3] (Useem and David, 2000). This was also evident from the *'Network Externalities'* (Shapiro and Varian, 1998)

[3] *'There won't be any Internet companies. All companies will be Internet companies, or they will be dead'* – Andy Grove (2000)

as evident through Metcalfe's Law[4]. Eventually it is expected that firms of all sizes, sectors and from all countries would adapt e-business to survive, however their adaptation rate and maturity of adaptations would vary with time. This thesis examines fifteen Indian listed companies from old economy (comprising five different sectors and three different sizes) to check their e-readiness levels from stakeholders' perspectives. A well coordinated network of stakeholders for a firm eventually provide the basis for well coordinated supply chains and thereby emerges the *'Real-Ttime Enterprise'* (König and Weitzel, 2005). For new economy players, the business models kept on evolving as Internet itself evolved rapidly. This thesis looks at the impact of local factors in evolution of business models of B2B players in India by examining the services offered by four leading Indian B2B players.

Internet offered immense scope (along with converging ICTs) as a social tool for the benefit of the poor (Krattenmaker, 1998). The nearly simultaneous evolution of IT, ICTs and Internet during late 1990s and its initially higher penetration amongst richer countries (and people) led to the debate of digital divide and thinking that it would further worsen income divides. However subsequent studies showed signs bridging of digital divides (Fink and Kenny, 2003) between rich and poor countries, although digital divides existed within societies in a country. Panda and Mishra (2004) pointed out that infrastructural divides – of electricity, roads, or education existed amongst the poors for ages. Role of mass-media (with niche characteristics) and benefits that Internet could offer as a unique mass-media were also well classified (Koert, 2000) towards that objective.

[4] Metcalfe's law, presented around 1980, states that the value of (many of the) telecommunications networks is proportional to the square of the number of connected users of the system (n^2). From economic network analysis, value of a fax machine, phone, or that of an online chat site or online marketplace increases proportional to the square of number of users, when value of a single such machine is effectively nil.

Internet Applications	What: Data	Function: How	Network: Where	People: Who	Time: When	Motivation: Why
BA: Business (e-business)	Real time Business Data	Stakeholders' interactions	Global	Firm (both old and new economy), stakeholders	Any time	Better reach, efficiency, cost control, services, profit, opportunity
GA: Governance (e-governance)*	Matching real time needs of citizens with govt. resources	Online interface amongst citizens, govt, and 3rd parties	National, can be amongst nations also	Govt., Citizens and other stakeholders	Any time	Better quality of governance, inclusive governance
PA: Personal/Individual Usage*	Need of information, communication and network	e-mail, online information, search, commerce, e-gov, etc.	Customized, can be global (social networks)	Individuals, Internet users	Any time	Convenience, better informed, lower cost, interactivity
SA: Socio-economic (as a social tool for the underprivileged)	Information relevant to underprivileged communities	Thro' a means of low-cost ICT tools – mobile/free content	Mostly local networks, however applicable globally	Underprivileged sections/Non-profit organizations	Any time	To improve standard of life of poor and illiterate (or less educated) people
Drivers of above appl	Drivers, as enablers, further facilitate and enhance usage of Internet applications of all types.					
DC: Digital Convergence	Multimedia data, covering all of above	Convergence of media, TV, telecom and computer	Global, and across networks – telecom, cable and Internet	Consumers and affected sectors and their stakeholders	Any time	Convenience and cost for consumer, cost vs. reach for producer
SE: Search Engine	Customized individual queries, Universal Access of Information	Through search engines	Global (over WWW), customizable	Internet users across devices due to DC	Any time	Convenience, cost, Universal need

Table 1.4: A Framework for Internet Applications and User Groups

(Adopted and modified from Zachman's Framework, 1987)

** not considered in the scope of the thesis, **Bold** highlighted ones were studied*

With billions of existing web-pages and thousands or more getting added daily, there was abundance of information in the web for the connected ones who could master one of the global languages of the world (like English). However that was not the scenario in many of the countries in two of the most underdeveloped regions (South Asia and Sub-Saharan Africa) of the

world. So there was a need to develop locally relevant content in local languages as well for the benefit of those less-educated underprivileged people belonging to linguistically diverse backward regions (and not knowing top languages of the online content).

In this thesis digital divide, infrastructural divides and income divide was studied on a global context although the focus was more on developing nations. On relative lack of online content, the focus again was the developing nations from the two most under-developed regions of the world (World Bank, 2006), South Asia and Sub-Saharan Africa, both exhibiting high degree of linguistic diversity.

Digital convergence continued to affect many industries and more importantly processes of many industries simultaneously (Graham, 1996). Bradley (2000) suggested the present period to be a *'network period'* characterized by a convergence of three main technologies: computer, telecommunication and media. There has already been a fair degree of convergence between media and the computer with Internet being the common platform; however same could not be claimed about telecom. However quite a few work-in-progresses have been initiated in this space in search of that killer platform to bring these two sectors together (Robinson and Levy, 2008) and one of those earlier platforms which, according to many had the disruptive potential to bring telecom and Internet together, was VoIP. Innovation and innovator's dilemma (Christensen, 1997) was a key area on convergence between telecom and Internet, and VoIP had and according to many, still has the potential to be one of the killer applications, albeit with prevailing uncertainties. In the form of a descriptive case, this thesis studied the acquisition of VoIP leader Skype by eBay to examine how digital convergence drives Internet applications on an ex-ante basis.

The other interesting development that took place amidst this online information revolution, with billions of existing web-pages and with new additions every day, was the
role of the search engine as a driver of WWW. Google increasingly came into focus through its better search techniques and market leadership having its mission statement as to *'organize the world's information and make it universally accessible and useful' (Wikipedia on Google Search, accessed in 2007).* With possibilities of that being achieved through search engines over

computers or mobile phones, search engines and primarily Google had a much more fundamental impact on the whole of WWW itself. By doing so, Google increasingly strengthened its position as the *'Social Gatekeeper'* (Nielsen//Netratings, 2004; Skidmore, 2004) of the Internet world. Google also took lead to have Internet-based convergence in mobile communications (Project Android as an operating system and subsequently Google's Nexus One Phone), other than converting millions of printed books online by partnering with leading libraries of the world and many such initiatives. It was increasingly becoming clear that search engines, more so dominant ones like Google and its initiatives can influence the future shape of Internet, and thereby many of its socially most relevant applications. Therefore other than being a leading generic application of Internet, Google also influences the other applications and their penetrations, and thereby having its influence on how users use overall Internet applications. This thesis studied the descriptive case of Google in terms of its growth, product offerings and business model to examine impact of search engines on Internet and on society.

There have been two other important application areas from users' perspectives. These two were identified in **Figure 1.4** as areas of e-Governance and the area of individual usages and applications. The applications and the drivers in **Figure 1.4** were not mutually exclusive; so it was expected that glimpses of insights on these two areas were likely to emerge from studies of remaining two applications. There were particular similarities in applications of Internet as a social tool and e-business with that of e-governance; and all the four applications depended on individual usages of Internet. People adapted Internet for varying reasons, and they also moved up in the value chain starting with e-mails in early days to have one-to-one communication to transacting online to publishing their views in blogs and in various other Web 2.0 forms or networking in social networking sites. Time magazine (Grossman, 2006) acknowledged the individuals collectively, as *'you'* to be the person of the year for 2006 for the collective contribution of individuals as users in revolutionizing the world through User Generated Contents (UGCs). In the framework of the thesis, all these four application categories form the backbone of Internet applications from users' perspectives. Reasons of subsequent exploration of two application areas and not the other two (GA and PA) were purely operational.

1.10 Literature Review

Extensive literature review on each of the application areas and drivers are presented in respective subsequent chapters. A brief summary of literature review on the scope is presented in chapter.

The perspective from the business usage of Internet saw the emergence of new economy players that boomed with the Internet bubble of late 1990s and busted subsequently, focusing on broader business models like Business-to-Business (B2B) e-commerce, B2C e-commerce, etc. New powerful technologies had created bubble before dot-com companies did, as it had been witnessed with power utilities in 1880s when stock prices of these companies went up by 1000%. However like the dot-com bust, within two years, the stock prices of electricity companies during 1880s fell to 5 to 15 per cent of their former highs (Figueiredo, 2000). The Internet in the 20th century repeated what electricity had done to manufacturing in the 19th century; that is enabling companies to do business incredibly efficiently quickly (Cairncross, 2002).

Stages of Growth Model was extended in B2B e-business (Caroline and Swatnam, 2004), whereas Jutla et al. (2001) came up with e-business stakeholders' model covering stakeholders like partners, community and government. Straub and Watson (2000) proposed the Hexagonal (Hex) Model of Firm Interactions, with inclusion of stakeholders like customer, employee and investor. Lin et al. (2005) highlighted on the variety of web-based service applications like overall process integration across functional lines, supply chain management, and in the areas of Knowledge Management practices.

E-Business adaptation within firms also varied with country-perspectives. Gibbs et al. (2002) found global, environmental and policy factors influencing e-commerce diffusion. It concluded that B2B e-commerce is driven by global forces through increasingly globalized competition and *'MNC push'*. The annualized Economist Intelligence Unit (EIU, 2004 and EIU, 2006) rankings of nations on e-business readiness provide this measure and the variables. India's position was 46th (it surveyed around 70 leading nations) in 2003 and 2004, which went down to 49 and 53 in 2005 and 2006 respectively. The reasons offered by the EIU study was echoed by Rastogi (2003) also, who identified some of the barriers like limited Internet access among customers and SMEs, poor telecom and infrastructure for reliable connectivity, multiple gaps in the current

legal and regulatory framework, and multiple issues of trust and lack of payment gateways to e-commerce adaptation in India. Much of that trend continued in 2009 as well.

The other important dimension of the business perspective, applications and impact of Internet has been the evolution of business models of a new generation of Internet players. Michael Rappa (2006) categorized business models in brokerage (further divided in Marketplace exchange, Buy/sell fulfillment, Demand collection system, Auction broker, Transaction broker, Distributor, Search agent, Virtual marketplace), Advertising Model (Portal, Classified, User Registrations, Query based Paid Placement, Contextual advertising, Content targeted advertising, Intromercials, Ultramercials), Infomediary Model (Advertising networks, Audience measurement services, Incentive marketing, Metamediary with examples), Merchant Model (Virtual merchant, Catalog merchant, Click and mortar, Bit Vendor, with examples), Manufacturer (Purchase, Lease, License, Brand integrated content), Affiliate model (Banner exchange, Pay-per-click, Revenue sharing), Community model (Open source, Public broadcasting, Knowledge networks), Subscription model (Content services, Person-to-person networking services, Trust services, Internet service providers) and finally Utility model (Further categorized in Metered usage, Metered subscriptions).

While examining the evolution of e-business models of new economy players, the thesis specifically focused on the B2B segment in India. A lot of online services with e-auctions on both ends of the supply chains emerged and old-economy firms (as customers) experimented with these online negotiation tools, primarily for cost cutting measures (Kumar and Chang, 2007). The other notable B2B model focused on the various forms of marketplaces and exchanges (Li and Li, 2005). A lot of research in late 1990s and early 2000 also spoke about very high potential of these E-hubs, and how they can transform the B2B landscape (Kaplan and Sawhney, 2000). Gupta (2006) sought explanations why India failed to produce a single global Internet brand in spite of having good talent pool.

The dot-com crash was severe (**Figure 1.5**). It even led to many becoming non-believers in the power of Internet as a whole, and whether e-business still mattered. However many felt that the shakeout was a necessary evil. One research study from Gartner Group (2002) reported the

global hype cycle of this evolutionary journey of internet economy starting with (I) Equity times triggered by internet technology (1990-1999), followed by (II) Peak of inflated expectations (1998-2000), followed by (III) Trough of disillusionment (2000-2003), and then by (IV) Slope of enlightenment and finally by (V) Plateau of profitability (2003 onwards). It further consolidated above five into three distinct phases in terms of financial performance of these sectors that of (I) Equity times (1990 onwards), (II) Debt times (1999 onwards) and (III) Positive cash flow (2004 onwards).

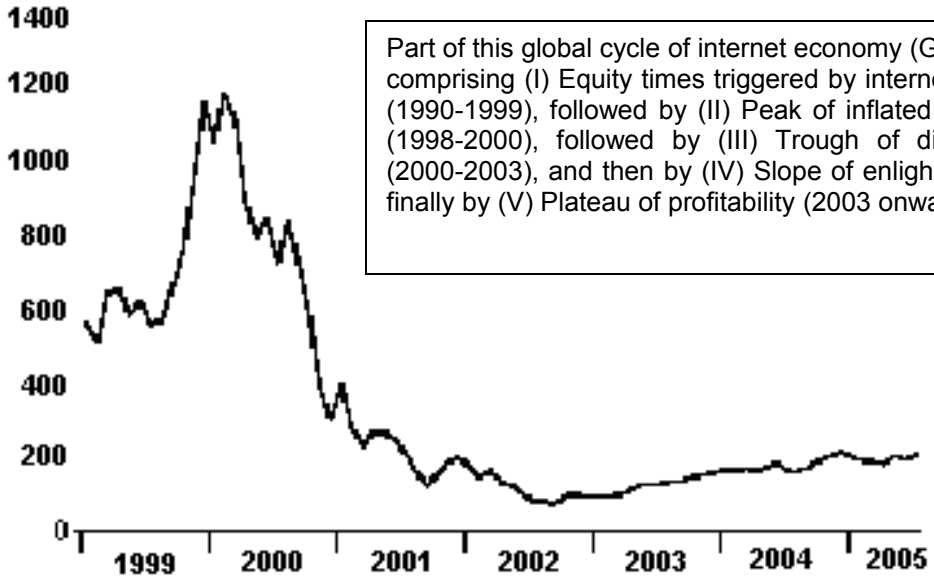

Figure 1.5: Performance of Internet Stocks

Source: The Street.com Internet Index as cited at Standard & Poor's, Industry Surveys, And Computers: Consumer Services & The Internet, September 1, 2005

After the dot-com bust, the Internet evolution continued with emergence of new powerful business models, driving primarily on the advertisement revenue model. Starting with search engines to the convergence of media with the computer where Internet facilitated that convergence as a driver, it has been continuing with new forms of Internet players like Social Networking sites, and User Generated Content (UGC) sites. Many of these were classified as Web 2.0 popularly, though the term Web 2.0 as a new concept had a debatable definition and foundation. Google increasingly emerged as the leader of the Internet world, and many

considered it to be following the same league of technology leadership following IBM and Microsoft (Dodge, 2007). Most importantly, many of these dotcoms started delivering positive cash flows, moving away from eyeballs and similar measures, that too without blowing away money on advertising for customer acquisitions, a trend established prior to the dot-com bust.

At the same time, developments were no longer isolated within sectors; they affected players and all users alike across sectors. Digital convergence was in the doorstep threatening traditional sectors like telecom with Internet-based applications like VoIP. The Economist (2005), on the potential of VoIP stated '*it is now no longer a question of whether VOIP will wipe out traditional telephony, but a question of how quickly it will do so. People in the industry are already talking about the day, perhaps only five years away, when telephony will be a free service offered as part of a bundle of services as an incentive to buy other things such as broadband access or pay-TV services.'* Others termed it as triple-play time (Crampes and Hollander, 2006). Nainis (2007) talked about VoIP to Quad-Play convergence with the elements of voice telephony, video, Internet access and wireless communications. Although mobile telephony costs came down drastically, more so in developing nations like India; the Economist probably was optimistic on VoIP's potential without realizing the uncertainties these disruptive innovations present. VoIP, at least as it stands now, could not keep its promise; however that does not rule out VoIP itself in a new form or new killer application/s on the web bring real convergence of these two sectors.

The search engines increasingly dominate how users access the Internet content around the world, and thereby the advertisement on the online media (Couvering, 2004). Understanding business model of search engines therefore could be akin to understanding the functioning of Internet and its impact (Miller, 2006).

Panda and Mishra (2004) pointed out that infrastructural divides – of electricity, roads, or education existed amongst the poors for ages whereas digital divide, although bridging, was new. On social applications of Internet (and more for the underprivileged) and its impact, the early literature focused on the so-called *'digital divide'* dimension, arising from the widespread concern that the explosive growth of the Internet was exacerbating existing inequalities between

the information rich and poor (Norris, 2001). However subsequent rapid growth in mobile communications in many of the developing and even in less developed nations saw digital divide to be narrowing (Fink and Kenny, 2003). At the same time in web-content analysis Lazarus and Mora (2000) found that many underserved communities were not benefitting fully from online content due to barriers like languages. McLuhan (1994) discussed the likely impact networked electronic media on the world. Role of mass-media in alleviating poverty and illiteracy is well established (Koert, 2000), where language was identified as one of the barriers of media-richness.

In this thesis, a lot of current developments have been sourced from non-academic publications (web-based), like news articles or Web 2.0 sources (e.g. Wikipedia, blogs). The credibility and the authenticity of these have been duly verified. This characteristic is deliberate from the objective, scope and methodology perspectives of our research. Internet and Web 2.0 has redefined literature and the way it gets searched and found, with its due opposition (Goswami, 2007). In the Internet age when blogs are termed as *'old media'*, new forms of content emerge under market forces for *'attention-deficit-disorder medium for an attention-deficit-disordered age'* (Leonard, 2008). Wikipedia (seven years old, since 2001), as a key word search in Google Scholar, resulted in 101,000 matches whereas Harvard Business Review (eighty-six years old, since 1922) resulted in 224,000 matches (as on 24th March, 2008), although the two may not be serving same target segments.

The thesis cites literature in its conclusion section (chapter 6) to (1) compare our findings with the findings of others to highlight the similarities(or differences and the context for the difference), (2) to explain the limitations of this thesis from other important perspectives on impact of Internet on society, and (3) to highlight scope of further work. Literature citation in the conclusion sections of each of the chapters is aimed primarily at point (1) above.

1.11 Research Questions and Methodology

Combined research approach with more focus on qualitative (exploratory and deductive) research along with (improvised) quantitative research was used in this thesis. Deductive

research was used to test existing theory and was the approach followed in well-studied fields (Lee, 1999) like in examining benefit of Internet for the underprivileged (Social Applications). As the scope of the thesis got defined in an exploratory manner within the framework of **Figure 1.4**, it followed more of Circular Model of the qualitative research process rather than following a Linear Model of research process. From preliminary studies and literature review, we followed circular inter-linking of empirical steps (**Figure 1.6**), as suggested by Glaser and Strauss (1967) and Flick (2006), as it was felt that this method unfolded the real potential of the thesis. Many of the perspectives (user participations), applications (i-Phone or evolution of online news or that of YouTube) and impact of Internet covered in this thesis emerged during the tenure of the PhD itself, and therefore following a linear model could have limited this holistic approach to more of the study past developments than on the current ongoing ones.

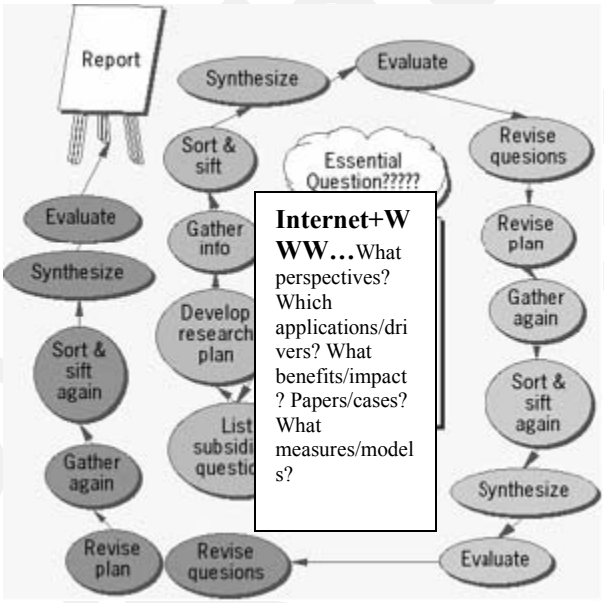

Figure 1.6: Cluster Diagram of Circular Research for Internet-based Applications, Their Drivers and Impact *(Adopted from Glaser and Strauss, 1967; and modified for this thesis)*

The research questions and the methodology followed thereby evolved following a circular causality than linear causality as in traditional linear research designs. However there are limitations in both linear research and circular research while dealing with evolving areas, as is the case with Internet. Assuming the hypothesis that Internet is more of a *'work-in-progress'*, there's the obvious danger of past being rewritten continuously at an unforeseen pace. At the

same time, the ongoing developments could be pre-matured to be taken up for conclusive research due to lack of firm trend which at times resembled an age of digital anarchy (Goswami and Kumar, 2008). Facing this trade-off, the thesis adapted exploratory circular research methodology as it still offered us the opportunity to view the ongoing snapshot picture of applications, drivers and impact of evolving Internet space. The research questions therefore needed to capture both the broadest and latest developments, within specific perspectives and applications, to gauge potential benefits and most critical social impact.

The thesis started with the broadest research question regarding applications, drivers, benefits and impact of Internet. While attempting to answer it, the need for a classification framework of most influential applications, drivers (users' perspectives) emerged. **Figure 1.4** and **Table 1.4** provided the guide map to proceed further on this area. Although there were other opinions on classifications of stakeholders of Internet itself (Clark et al., 2005), those were again more of a technical stakeholders than users. The thesis took the user-perspectives in applications and drivers of Internet, and subsequently adopted a modularized approach in understanding them. In each of these modules (different chapters in the thesis), the thesis asked specific research questions pertaining to that module.

The broadest and original research question, as it emerged from the background and literature, was to find *'what has been the most critical impact of Internet on society, and what have been its potential benefits?'* Due to the complexity of the question, the approach adopted was to classify Internet applications and their drivers in major user-categories, and subsequently to study couple of applications, their drivers and their impact for insights. The motivation for doing so was with an expectation that insights gained can help academicians, practitioners and policy-makers anticipate and plan for the most critical impact of Internet on society and gauge comprehensive benefits from it. Therefore the thesis modified the original question (following a break-down manner) as '*What have been the major categories of Internet applications, what have been their drivers and also what has been their impact on society?'* And by studying subsequently how these applications and drivers evolved, the thesis tried answering potential benefit and impact of Internet on society comprehensively.

The subsequent research questions evolved from above following a circular model from the scope as identified in **Figure 1.4**, and further from two of its applications (BA and SA) and the two drivers (DC and SE). These subsequent research questions were modular and focused on respective applications or drivers.

1. On Business Applications: This section had two questions – one for the old-economy players and the other for new economy ones. For old-economy players, the research question was
    a. *From a stakeholders' perspective, what has been the trend of adaptation of e-business practices in firms of different sizes and sectors, and why?*

Whereas for new economy players, the research question was

    b. *How have the business models of new-economy players evolved and why?*

Both of above questions again being broad, the trend of adaptation of e-business practices in old-economy players was categorized as per sizes and sectors within Indian context, and the e-business practices adapted were studied in reference to stakeholders' requirements. And for the new economy players, the focus was on B2B players and again within Indian context.

2. On Convergence: *How has been the trend and what is the impact of Internet driven digital convergence and how does it affect different sectors?* The thesis explores, in the form of a management case, the incident of eBay's (an Internet player) acquisition of Skype (a VoIP player) to get the larger picture of convergence between Internet and telecom space.
3. On Search Engines: As search engines increasingly play an important role in the World Wide Web, it was important to understand the business model of a search engine. Google emerged as the strong contender to be the gatekeeper of the Internet, and therefore understanding Google to understand Internet followed naturally. This essentially follows from the Circular Research methodology by asking the question: *Who (people, organizations or individuals individually as well as collectively) influences the Internet, its applications the most; and why; and how.*
4. Finally on Social Applications for the underprivileged (SA or broader ICT4D): *What does Internet and the broader ICTs offer for the billions of underprivileged people of*

our world? This again is studied in two parts – one on the area of increasing access to ICTs (as opposite to digital divide of earlier times) coupled with increasing income inequality, and the second on analyzing the mismatch of online content for linguistically diverse populace for South Asia and Sub-Saharan Africa, where majority of the underprivileged people of the world live.

The resulting research questions therefore span a broad scope by exploring the applications of e-business across sectors and sizes to the evolution of business models of B2B players, business model of the most powerful player (Google) of the Internet; to the impact of digital convergence, and finally on the applications, drivers and impact of all of it on wider populace. The reason for selecting these set of specific research questions within the broader scope of **Figure 1.4** (and not on the other two application areas) is operational in terms of managing the scope, and a result of the exploratory circular research methodology that the thesis followed.

It must be stated here that although no specific research tried answering above research questions on Internet applications along with drivers and impact on society, the broader perspectives and applications framework of this thesis partly matches with the *'i2010'* document of the Europe's Information Society (2005) or with that of Rao (1999).

1.11.1 Suitability of Case Methods and Need of Improvisation in Methodology

A management case essentially describes better an evolving market or industry or trend. Yin (1994) highlighted that case research and survey methods are better suited than other techniques for analyzing contemporary events. Case study research has its advantages in new topic areas (Eisenhardt, 1989). A major part of the thesis wanted to understand more of *'what is happening'* and *'why it is happening'* to understand the impact of Internet applications and particularly its drivers on society. Westgren and Zering (1998), facing a similar dilemma, suggested the efficacy of case methods. They suggested archived data and quantitative tools better answer *'what happened'* than either *'what is happening'* and *'why is it happening'* research questions as relevant for evolving markets, technologies, applications or even to get a sense of the overall impact. Westgren and Zering (1998) also felt that case methods were even better than surveys 'a*t answering the "whys" and "hows" because the case analysis can delve more deeply into*

motivations and actions than structured surveys'. They felt that in surveys, one can surely get more depth of analysis, but the trade-off is the breadth. And for wide-spread issues on Internet applications, more on digital convergence and on search engines, breadth was needed due the enormity of the subject. Westgren and Zering (1998) also found that research cases offered unique tools to build theory by examining phenomena not suited to the traditional statistical approaches. Rare events and novel developments are most suited to be such phenomena. Internet impact on society still happens to be novel in that respect.

Yin (2003) further defined a case study as *'an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident. In other words, you would use the case study method because you deliberately wanted to cover contextual conditions —believing that they might be highly pertinent to your phenomenon of study'*. Zachman's (1987) framework suggested a similar approach for contextual conditions. Yin (2003) also suggested, in line with Westgren and Zering (1998), that descriptive '*case studies are the preferred strategy when "how" or "why" questions are being posed, when the investigator has little control over events, and when the focus is on a contemporary phenomenon within some real-life context.'* The research questions this thesis asked had all these attributes (little control of events related to Internet applications, drivers and impact; contemporary event and contexts comprising pervasive use of various Internet applications by almost every type of user-segments).

Internet based survey was also used in some sections as a methodology (BA), at times complementing the case studies simultaneously. Google Indic On-Screen Key Board (Google, 2007) was used to get a measure of online content availability in local languages of India. Data from multiple secondary sources were compiled together and deductive reasoning was applied to find insight from that to address this thesis-specific research questions.

Significant efforts were made to get adequate responses through on e-mail based survey and by online survey (using surveymonkey.com to conduct online surveys); however both these efforts did not prove to be much successful in terms of targeting right audience through representative sampling (due to lurking).

This thesis with the broad area of study and having broad research questions invariably met above challenges in its research cycle as presented by Ali (1998), more with its original data collection part, as things did not work out as per original plan or even as per subsequent alternate plans. Many researchers recommended following the circular research methodology (Gill and Johnson, 1991) with induction method in similar context as general conclusions can be drawn from observations, implying that induction relates to the right hand side of Kolb's learning cycle, as given in **Figure 1.7.**

At constructing and evaluating explanatory statements, or theories, about what is happening around us with the Internet, the research approach followed in this thesis was similar to what Ghauri et al. (1995) suggested on asystematic approach to business research (due to the scope and pervasiveness of applications and impact).

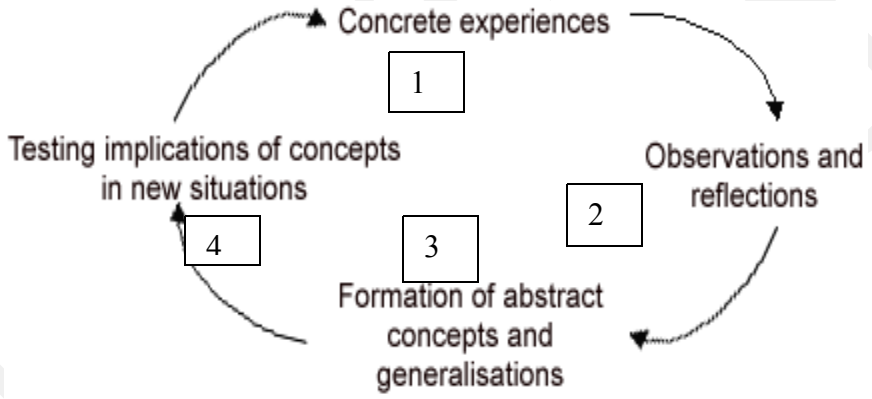

Figure 1.7: Kolb's Experiential Learning Cycle (Source: Gill and Johnson, 1991)

1.12 Data Collection

Research in this thesis used both primary and secondary data while addressing the research questions in the two applications-areas and two drivers under study. Relying primarily on primary data to address such broad scope of the research was difficult, keeping in mind the resource requirements and the breadth of the study. So the thesis depended a lot on secondary data sources, which was abundant on a macro-level. In many instances, discrepancy in secondary data (as in the case of Internet user base in India or in the context of web-pages in different global languages) has been found and reported.

The validity, credibility and suitability of secondary data for this specific research were rechecked with multiple credible sources on the web. Internet as such offers a lot of quality secondary data, in many of the evolving upcoming areas of this research as well where it was nearly impossible to get any primary estimate of similar data. Internet tools or surveys based on researcher's interpretation (Myers, 1997) yielded desired specific primary data for parts of this thesis. Applications of Internet based tool (Google Indic On-Screen Keyboard, 2007) further yielded primary data while calculating local languages content against content in English with same keyword search. "Googling" increasingly emerged as one of the most popular ways to find primary as well as secondary data (Aytac, 2005).

Efforts to get more primary data by e-mail surveys and also from online surveys also didn't yield much result. A significant amount of effort was spent in contacting top management of various industries multiple times following random or even convenient sampling methods. Various industry associations were contacted to have larger sample size to justify the research scope. However after some initial response, no tangible co-operation from these firms or associations was received. An online method of surveying our target audience with Internet-based research tools (e.g. surveymonkey.com) also did not deliver much credible or reportable result. Following the circular research methodology, the thesis therefore had to rework on the research design, scope and questions a few times.

1.13 Chapter-wise Summary of the Thesis

The introduction section (Chapter 1) provided the background, need and objective of this research, brief literature review on objective and main research question, subsequent research questions and objectives, the thesis framework on applications and drivers of Internet and broad research methodology followed in subsequent sections. The subsequent parts of the thesis are modular, and are broadly independent in its research methodology. Each module as a different chapter has its own research problem and is followed with its own literature review as initiated from this introduction section. Finally the whole thesis gets its conclusions from the findings of these four modules and related developments on a comprehensive basis to answer critical impact of Internet on society. Essentially all these modules look at different perspectives of Internet

users, applications and their impact as identified in the research question and scope section to meet the objective.

The order of study of the two applications and the drivers followed in this thesis (subsequent to the Introduction section (Chapter 1)) is as below:

1. Chapter 2: Business application (BA) of Internet and its impact
    a. Section I: Stakeholder perspective of e-readiness in business firms from the old-economy (Chapter 2.1) examines how firms from different sizes and sectors have adapted in Internet-media in interacting with their stakeholders.
    b. Section II: Examines impact of local factors in evolution of business model of Indian B2B players (Chapter 2.2).
2. Chapter 3: Digital convergence (DC) as a driver of Internet applications and its impact, in the form of a case on acquisition of VoIP leader Skype by eBay, on an ex-ante basis covering developments in 2005 that led to the acquisition.
3. Chapter 4: It comprises 'A study of Google as the Internet Search Engine' in the form of a descriptive management case. It examines search engines (SE) as driver of Internet applications, emerging trends of Internet as visible from business models of search engines and their impact on society, by studying the business model of Google, the market leader.
4. Chapter 5: Socio-economic applications (SA) of Internet for the underprivileged and its impact
    a. Section I: 'Bridging of digital divide amidst increasing income divergence' examines Impact of Internet/ICTs as an infrastructure and potential of its universal access amidst age-old infrastructural divides; impact of bridging of digital divide on income divide (Chapter 5.1).
    b. Section II: 'Online information poverty in local languages – new forms of digital divide emerge' examines poverty in online content in local languages of South Asia and Sub-Saharan Africa due to linguistic diversity, and its impact on the underprivileged people from these two regions (Chapter 5.2).
5. Chapter 6: Conclusions