

SOCIAL CONSTRUCTION OF INFORMATION AND COMMUNICATION TECHNOLOGIES: A STUDY OF SELECTED DEPARTMENTS OF THE GOVERNMENT OF ASSAM

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DECLARATION

I hereby declare that the thesis entitled “**Social Construction of Information and Communication Technologies: A Study of Selected Departments of the Government of Assam**” is the result of investigation carried out by me at the Department of Humanities and Social Sciences, Indian Institute of Technology Guwahati, under the supervision of Prof. Sambit Mallick. The work has not been submitted either in whole or in part to any other university/institution for a research degree.

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CERTIFICATE

This is to certify that Ms. Tripti Das has prepared the thesis entitled **“Social Construction of Information and Communication Technologies: A Study of Selected Departments of the Government of Assam”** for the degree of Doctor of Philosophy at the Indian Institute of Technology Guwahati. The work was carried out under my supervision and in strict conformity with the rules laid down either in whole or in part to any other university/institution for the purpose. It is the result of her investigation and has not been submitted either in whole or in part to any other university/institution for a research degree.

IIT Guwahati
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Sambit Mallick
Supervisor

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Abstract

Information and Communication Technologies (ICTs) have played an essential role in modernity and the social sciences today and have contributed to debates on how modernity has been fluid in the 21st century. ICTs have brought about changes in social, cultural, political, economic, ethical, legal, and institutional domains, and these changes are referred to as late modernity or postmodernity. Investigating the role of ICTs in building human capabilities and their role in shifting social life is essential. Information and communication technologies are perceived as a tool for development. Further, it has been acknowledged as a problem-solving source and generating growth that aims at concrete deliverables to society. Development agencies have applied ICTs in various projects as a means of development. Policymakers of developing countries have introduced ICTs to establish good governance. The present study is an attempt to examine about the relevant technologies that different departments of government of Assam have been introducing to connect different communities, to improve livelihood of people, and to facilitate the activities of the state run institutions. As the study aims to look at the ICT application and its diffusion from Social Construction of Technology approach, therefore this study assumes greater significance in the context of the conflicting interest of various stakeholders, viz. the state, state- regulated departments, civil society organizations and the citizens i.e. the interest and meanings associate with different technologies indicate differing perspectives of various stakeholders. Organizations are chosen for the present study as they are such platforms where different stakeholders can act together. A part of the study also looks at the emergence of Information and Communication Technologies in the context of cultural and social factors in India and government initiatives on the diffusion of Innovation for the broader development of the nation and the development of the various regions. The study also applies Actor Network Theory and culminates that a particular technology is shaped by a combination of individuals, groups, organizations, and practices interconnected to cause change towards a particular purpose. While shaping a particular technology, individuals, groups, organizations, and practices are networks seen as a mix of humans and non-humans with different identities. The study aims to observe

the ICTs' implementation and diffusion in government organizations and its institutionalization by seeing ICT as a social practice that establishes social interaction among different entities through communication channels. The study of impact of ICTs is also a part of the Information System Research. Therefore, in this study it is found that changes occurred as a result of an innovation in general and ICTs in particular is not a linear process. It is more or less influenced both by the characteristics of the innovation itself and the particular context where it operates. ICTs is not something that can be injected from outside to bring some changes. Rather it has to be examine in terms of a number of factors such as economic resources, employment, health, education, civic engagement and culture to make it inclusive in nature.



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Abbreviations

AMTRON	Assam Electronics Development Corporation Limited
ANT	Actor Network Theory
BARC	Bhaba Atomic Research Centre
BPO	Business Process Outsourcing
BSNL	Bharat Sanchar Nigam Limited
C-DAC	Centre for Development of Advanced Computing
CIC	Central information Commission
CIDCM	Center for International Development and Conflict Management
CSC	Common Service Centre
CSI	Computer Society of India
DoE	Department of Electronics
ECIL	Electronics Corporation of India Limited
ERNET	Education and Research Network
ERP	Enterprise Resource Planning
EU	European Union
GMC	Guwahati Municipal Corporation
GoA	Government of Assam
GoI	Government of India
HMS	Health Management System
HSLC	High School Leaving Certificate
IBM	International Business Management
ICTs	Information and Communication Technologies
IISc	Indian Institute of Science, Bengaluru
IIT	Indian Institute of Technology
IMF	International Monetary Fund
INC	Indian National Congress
ISI	Indian Statistical Institute
IT	Information Technology
MDG	Millennium Development Goal
MIT	Massachusetts Institute of Technology
MNE	Multinational Enterprise
MTCS	Mother and Child Tracking System
NCST	National Centre for Software Technology
NIC	National Informatics Centre
NIIT	National Institute of Information Technology
NIRD	National Institute of Rural Development
NPC	National Planning Commission
NPM	New Public Management
NPMU	National Project Monitoring Unit

NTITSD	National Task Force on Information Technology and Software Development
OECD	Organization for Economic Co-operation and Development
PPP	Public–Private Partnership
PRC	Permanent Resident Certificate
PSU	Public Sector Undertakings
SCOT	Social Construction of Technology
SIR	Scientific and Industrial Revolution
SPMU	State Project Monitoring Unit
SSK	Sociology of Scientific Knowledge
STS	Science, Technology and Society
TCS	Tata Consultancy Services
TD	Technological Determinism
TIFR	Tata Institute of Fundamental Research
TRAI	Telephone Regulatory Authority of India
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific, Cultural Organization
VLE	Village Level Entrepreneur
WDR	World Development Report
WTO	World Trade Organization

Chapter I

Introduction

1.1 Background to the Study

People associated with policymaking, press, universities assert that humanity has entered a new epoch where information flows have changed hitherto existing social and economic relationships based on material goods. This new age produced by ICTs also requires new thinking (May 2003). The emergence of Information and Communication Technologies (ICTs), an essential contributor to and characteristic of contemporary modernity and social sciences, has been a part of the debate over how modernity changes the socioeconomic and politico-cultural relations in the 21st century. ICTs and their networking capacities have brought about changes in the social, cultural, political, economic, ethical, legal, and institutional domains, and these changes are referred to as late modernity or postmodernity (Kumar, 2005). As in computerization, networked computers and communication systems are accepted as part of daily life. Therefore, it is vital to investigate the role of ICTs in building human capabilities and their involvement in shifting social life. The ICTs are perceived as a tool to development in perspective.

Further, ICTs are acknowledged as a problem-solving source and generating growth that aims at concrete deliverables to society. Therefore, different development agencies have applied ICTs as a tool of development in their various projects. Policymakers of developing countries have introduced ICTs to establish good governance (Saith et al., 2008). India, after Independence, decided to make science and technology an integral part of its development

strategy. In the era of computerization, networked computers and communication systems are seen as becoming part of daily life. Therefore, it is of paramount significance to interrogate the extent and intensity of the objectives of ICTs towards social and economic inclusion. In the case of the Industrial Revolution, it was seen that it could not reduce poverty in developing nations. Globalization has also failed to bring about changes for the poor. It is thought that the revolution in Information and Communication Technologies can help break out of this unfortunate scenario. ICTs can reduce poverty by improving poor people's access to education, health, government and financial services. ICT can also help small farmers and artisans by connecting them to markets.

Nevertheless, both Government and private enterprises have initiated some innovative ICT projects in the rural areas. But because of geographical restrictions to some areas, they cannot reach out to every individual in the society (Mehta and Kalra, 2006). After the Economic Reform Policy of 1991, the main aim of India was to reduce poverty and build social infrastructure through proper economic management. It is often as recognized as crucial to the regeneration of the government. Through ICTs the rural people will be helped as they have access to knowledge about improving productivity in their work and health practices and learning about their environment. ICTs will empower rural people by developing the skills necessary to generate rural employment opportunities (Bhatnagar, 2000).

The terms '*Information society*', '*Information Revolution*,' '*Information Age*' emphasized the power of information that can change the work pattern and the lifestyle of the humans that leads us towards a 'utopian society'. Although the term information explosion occupied different areas of study after World War II, '*Information Revolution*' and '*Information Society*' were not used extensively. Economist Fritz Machlup in '*The Production and Distribution of Knowledge in the United States*, published in 1962, developed the concept of '*Information society*'. Again, the idea of Post- Industrial society originated in Daniel Bell's

(1973) writings, and later, David Lyon (1988) argues that Post- Industrialism was defined negatively. Lyon was very interested in going beyond the notion of determinism of Information Society and refused to accept the functionalist view of adaptation to technology. Instead of focusing on the new system's impact, he emphasized studying social shaping and the consequences of ICTs (Fincham, 1987).

In this context, the proposed study attempts to examine the relevant technologies that different departments of government have been introducing to connect different communities, improve people's livelihood, and facilitate the activities of state-run institutions. Moreover, the present study would like to know how equitable and all-inclusive socio-economic development of the entire state of Assam is connected with adopting ICTs in both private and public sectors. The study captures how within and across some of the departments of the Government of Assam as diffusion of Innovation literature, and some innovations have to be adopted and used by the organization before the community and ICTs adoption is not an exception. Again, Social Construction of Technology is how people perceive a new technology and its interaction among different individuals of a particular setting. Organizations are such platforms where different stakeholders get the opportunity to interact with each other. To learn about the diffusion of ICT innovation, it is crucial to know people's attitudes towards technology. Rogers defined Innovation and Technology as synonyms and argued that when a new technology emerges, people of a particular society can accept it or reject it depending upon its characteristics such as relative advantage, compatibility, simplicity, traceability, and observable research. For Rogers (2003), adaptation is a decision of "full use of an innovation as the best course of action available," and rejection is a decision "not to adopt an innovation". Rogers (2003) defines diffusion as "the process in which an innovation is communicated through certain channels over time among the

members of a social system". In his words, Innovation, communication channels, time, and social system are the four critical elements of diffusion of Innovation or Technology (Rogers, 1995, 2003). Therefore, diffusion of Information and Communication Technologies for broader development is seen determined by to what extent people are responsive to the consolidation of technologies. As reinvention is a critical principle in Diffusion of Innovations, the present study will be discussing the relevance of a successful project's demonstration in accepting a new form of technology for the all-inclusive development of the state.

1.2 Literature review

1.2.1 Science, Technology and Society Studies

Science, Technology and Society (STS) studies emerged in the 1970s and 1980s as an interdisciplinary field that comprises **History of Science**, **Philosophy of Science**, and **Sociology of Science**. Fuller (2007) mentions about three generations of STS research: the first is logical positivism, and in this generation, the Liberal-Philosophical assumption of the 17th and 18th centuries holds the view that science is a neutral study of nature and scientific knowledge as universal, atemporal, unvarying, and objective, i.e., autonomous and independent forces of production. For Kuhn (1962), 'science has to be examined in terms of its historical integrity. Such internalist characterization of science and technology may be seen in the works of Karl Mannheim (1936), who argues that all knowledge except scientific knowledge is socially conditioned and later Bloor (1976, 1984) broadens its scope and says that all knowledge, including scientific knowledge, is socially shaped. There is also a history, philosophy, and sociology of science as for STS research science is all about 'material practice,' which is termed *technoscience* (Fuller, 2007). By rejecting many of the fundamentals of the conventional view of science, STS perceives science and technology as

active processes and focuses on how scientific knowledge and technology are structured, not due to the privileged form of knowledge about nature. For STS, knowledge, and artifacts are human products and marked by the conditions of their creation. Social Construction of Knowledge leaves no room for the matter to play in making knowledge about it (Sismondo, 2010). Within STS, the term 'Social Construction' started to become popular in the late 1970s, seeing science and technology as a social activity and suggesting that science and technology products are not themselves neutral. The phrase 'Social Construct' has been borrowed from Berger and Luckmann's *The Social Construction of Reality* approach. Technological work includes different resources such as raw materials, skills, knowledge, capital, number of actors. Actor-Network, another theory of technoscience developed by Michel Callon and Bruno Latour, pointed out that all these heterogeneous elements create the success of technoscience; it does not depend upon only a piece of the network (ibid). Such crude division between the internalist and the externalist characterization of science is not rigid but porous or opaque. For example, according to Bourdieu (2003), we have to go beyond the absolutist-idealist conception of science on the one hand and the historical-relativist construal of science on the other.

Research on information and society is labeled with different categories such as internet research, ICT and society, social informatics, informatics and society, new media research, information society theories, internet studies. Social informatics defines the interconnectedness of design, use, and consequences of ICTs in a particular institutional and social context. ICT is a term used to indicate the technologies of cognition, communication, and cooperation that are computerized. The idea of ICTs and society association deals with two interconnected aspects- The Social Shaping of Social design of ICTs, and the impact of ICT usage on society (Fuchs, 2008).

1.2.2 ICTs and Development: Rise of Information Society

The word information contains different meanings, and the growing importance of information has led us towards a more complex, untidy state that prevents simple and satisfactory scientific analysis. Words get exercised in inventive ways in different contexts. As a technical term, 'information' was developed during the middle of the 20th century. The word 'information society' claims to include remarkable characteristics that contrast with some non-information societies. The main difference between industrial and post-industrial society is that industrial society uses material resources in the production process, and information society is related to selecting and processing new information.

Most of the meanings associated with the word information come under three categories: information as knowledge; information as the process of becoming informed; and information as things that characterize material things or physical actions (Buckland, 2017).

The definition of information age contains two aspects-economic and cultural. Kellerman (2000) mentions about three phases of the evolution of Information society. The contemporary thinkers of the '60s used various terms to define the image of the new society. Among the most prominent is AmitaiEtzioni's concept of 'The Post- Modern era,' George Litchheim's 'Post bourgeois Society,' Herman Kahn's 'Post-Economic Society,' Murray Bookchin's 'Post Scarcity Society,' Kenneth Boulding's 'Post civilized Society,' Peter Drucker's 'The Knowledge Society,' Daniel Bell's 'The Post Industrial Society,' Paul Halmos' 'The personal service society,' Ralf Dahrendorf's 'The Service Class Society' and Zbigniew Brzezinski's 'The Technetronic Era.'

The first phase, entitled "Information Rich Society,' is mainly based on information-related occupation and the use of information and progression of employment-related to it generated

a new phase, i.e., Information-based society (the 1980s-1980s). This phase features Globalization, where the gap between international boundaries could be lessened due to the internet, international telephony. During this phase, special devices such as telephone, cellular, fax, and personal computers were made to address specific needs. These devices made connectivity possible which could be seen as another characteristic of an information-based society. The third phase of the rise of information society was assumed to be started in the 1990s where information became a culture. At this phase, information values were promoted mainly because of national and individual development interests. Since the mid-1990s, many commentators have believed that the combination of Information and Communication Technologies has accelerated a new form of society: an information society. The concept of Information Society has been spreading both in academic and professional circles for almost more than 30 years. The theorists who are connected with the study of the new society, i.e., about the journey from industrial to a post-industrial society, address different vocabularies of the Information Society, including the evolution, progress, developments, trends, transformation, growth, and decline. Different writers and researchers have their views on the emergence of information technology as an industry and occupational change. They also talk about the informative culture of the new era and the power of digital technologies (Black & Muddiman, 2016). Alvin Toffler, the world's leading futurist, discussed the movement of society towards a new direction with different labels such as information age, electronic age, global-village, techno-electronic age, post-industrial society. According to him, the world has been decisively shaped by three waves of technological Innovation- the first was the agricultural revolution, the second was the industrial revolution, and the third was the information revolution.

The dark side of Industrialism in the West is also a reason for the emergence of the new society. Kumar (2005) used the term 'Diseconomy' to define the pollution, crowded situation, and the exploitation of resources in the name of development of Industrialism. Society was experiencing such a situation where progress was not possible. Conflict emerged among political ideologies and different sections of the society due to the inefficiency and irrationality of the bureaucratic organization. Therefore, there was a need for movement to a post-industrial society as an alternative solution to get rid of the problems of Industrialism. Another influential work, 'The Industrial State' by J.K. Galbraith, mentioned the transformation of power to the people of 'the techno structure' and the relationship between technological advancement and social development (cited in Kumar, 1978). Manuel Castells, whose idea is based on macro-level and global and social transformation, provided a detailed outline of the economy and society and the changing social structure in the era of information technology. He argued that the new information age had replaced the traditional, labor-intensive forms of the industry with flexible production. The new technology has also brought changes in terms of social organization because, in an organization, the source of production changes to information flows. In the organization, the system of bureaucracy changes to network enterprises. He argued that IT is the source of power in contemporary society (Castell, 1996). Many writers have developed definitions of information society dealing with a particular feature of the information society. These different features include different forms of economic production, new forms of social interaction, innovative processes of production.

From a sceptical standpoint, May (2002) refers to four claims of information and communication technologies which are represented mainly by the internet, and he states that these claims are interconnected –human civilization is experiencing a social evolution, the

information age is creating new economic relation, political practices and the pattern of community involvement are changing, the role of state and authority is also seen changing.

The sources of Innovation in industrial society are based on random inventions, but the innovation process is wholly based on theoretical knowledge in Post-Industrial society. No human history has been passing through without knowledge. The resource of pre-industrial society was only raw materials, and then industrial society used capital as resources. He made no difference between Post-Industrial society and information society. As a follower of Adam Smith and Marx, Bell (1976) argued that Post-industrial society is based on the knowledge theory of value that means value increases not with the labor but with the changes in knowledge. Bell did not say that the emergence of Post-Industrial society has wholly replaced the industrial society. Instead, he argued the whole system as a combination of different layers. Then he discussed the design of society in terms of socio-technical change. In the pre-industrial society, people had to depend on nature for survival, and it was a game between nature and individuals. In Industrial society, people use their energy to make large machines for the production process. Bell defines it as a game between man and invention while talking about Post-Industrial society, and he calls it a game between persons. Post-Industrial society develops interaction between different individuals (Bell, 1976; Webster, 1995, 2002, 2006).

Capitalism and the use of new technology brought radical changes to the globe only in 150 years (1750-1900), and as a result, a new civilization was established. What made capitalism from other ancient civilizations is the rapid diffusion of technological innovation from the West to other parts of the globe. According to Peter Drucker, this transformation also brought changes in the case of knowledge. Knowledge which was private good, became public good (Drucker, 1993).

Castells (1996) talks about the transformation of society from the industrial age to the information age, which is an outcome of the advent of information technology. Society remains a capitalist one, but the basis of technology means has changed from energy to information. Information Society theorists can be divided into two categories. Those who developed their theories on technological determinism (believed to be associated with American Sociologist and Economist Thorstein Veblen) see ICT as a driving force behind social change.

During the 1950s and 1960s, several countries achieved their economic growth targets, but it did not bring positive changes towards the masses of the countries. Therefore, the narrow definition of development was assumed to include absolute poverty, income inequality, and unemployment. So during the 1970's the concept of economic development was reinterpreted, and more attention was paid to reducing poverty, inequality, and unemployment (Todaro and Smith, 2003, 2006, 2009, 2012). According to the Modernization Theory of development, economic development is related to increased technological development (Anderson, 2008). The Modernization Theory postulates that the less developed countries will make progress if they follow the developed countries' economic and social development patterns.

1.2.3 Social and Political Shaping of Information Society

Granham (1998) defined social communication as the medium through which humans create/produce, distribute/exchange symbolic forms. Its study has been characterized by a series of dominant paradigms, which are themselves the product of broader historical, current- effects, and functionalism, the dominant ideology, audiences/ consumption. The study of information and Communication Technologies represents the present historical moment and the dominant development trends. Through his writing, Bertolt Brecht criticized the idea that technology is autonomous and controls social life. In the same way, Herbert- Marcuse, a German –

American philosopher, attacked the concept of Technological Determinism as the development of technology keeps no room for conflict and enables only systems of power and coordination. It is also argued that technology may obstruct people's economic, political, and intellectual freedom. Jurgen Habermas also pointed out that the advancement of technology has changed the productive force in society from political to technical. The study associated with the revolution of Information Society focuses on the interaction of actors who are part of a particular social and historical context—defining it as Information Technology Revolution describes some values, cause, and effect associated with the transformation process (Brants, 1989). Studies associated with the revolution of Information society focus on the interaction of actors who are part of a particular social and historical context—defining it as Information Revolution denotes some values, cause, and effect with the transformation process.

Disagreement is observed among researchers regarding the scope of the term 'Social.' While some researchers concentrate on human individuals as the crucial element of the social theory, others focus more on shared, socially constructed institutions. Within an organization, culture, social structure, functioning process, traditions, and rules influence the performance and thoughts of people of all age groups who become part of a particular organization, pass through, and disappear from the organization. The scope of social theory is restricted to individual entities and comprises culture and social structure. Individuals are seen as a product of social structure, and the social structures affect what the individuals think and how they act.

To understand the social shaping or social impact, it is essential to know the origins of technologies and their convergence. At the macro level, the activities of technologies are associated with the state's role, i.e., the government's military and commercial interests. At

the micro-level, the uses of technologies are seen in the introduction of computers in schools; in the domestic sphere, it is used on a large scale as computer games, computer-related periodicals. Studies about technology's social impacts always neglect human action within the technical process (Lyon, 2013). The 'Technological Determinism' perspective describes that organizations require information to function properly and to achieve goals. According to the idea of 'Technological determinism,' 'Technology has a kind of life of its own, and it shapes the existence of human lives. Therefore it is criticized on the basis that technology is not independent. It is a human product, a social construction. Though its social shaping is related to military, economics, and politics, human beings are involved in monitoring, evaluating, and justifying their activities. After being designed and implemented, the technical system provides the information required by the particular social system. The technical system is also seen altered depending on different information requirements for the technical system to satisfy. Within an organization, this process of transformational interactions continues until it reaches its closure. Following the development model of the West, the developing countries also adopted the ICTs for development approach that looks at how ICTs can lead to socio-economic development in developing countries. Avgerou (2010) dwells upon how the developing countries are experiencing the nature of ICT innovation and diffusion as a socially embedded action. It has also been discussed about the contribution of ICT towards development both in terms of progressive transformation and disruptive transformation.

Different researchers argued that culture plays a vital role in ICT innovation. There is a common assumption in ICT for development research that developing countries are lagging compared to developed countries, and this belief is named 'Digital Divide,' a new form of inequality (Kleinman, 2009). This inequality exists because of the different contexts under which the Innovation and diffusion of ICT development took shape. Therefore, the

experience of ICT utilization is varied among different sectors, countries, and regions. Other perspectives study the context under which ICT innovation is Diffused-Universalistic and Situated. The universalistic perspective studies innovation as a process independent of the involvement of the social actors. They more often talk about Innovation in the organizational context. On the other hand, situated goals of ICT innovation emphasize the meaning-making and practices of individual actors within an organization.

The transfer and Diffusion perspective sees the ICT innovation as the diffusion of knowledge that originated in the advanced economies and was later accepted and followed by the developing countries. The factors that make the differences between developed and developing countries in the diffusion of Innovation include economic conditions of the countries, technology competencies, people's attitude towards new technology, and institutionalized work habits. Again, the social embeddedness perspective focuses on how the ICT innovation and development in a developing country depends on the local context of that particular country, such as different organizational settings and the cognitive, emotional, and political capacities under which individuals of that particular society have been nurtured. The theories associated with the social embeddedness approach are Actor-Network theory, Structuration theory, and organizational institutionalism that establish a relationship between technology–society, agency-structure, and technical reasoning –institutional dynamics. The role of culture in ICT innovation in a developing country is a significant concern for the ICT for development studies.

ICT for development research tries to throw light on the contribution of ICTs in improving the lives of individuals in various ways, from reducing poverty to making the democratic polity strong. Avgerou mentions two perspectives of ICT-enabled development by refuting two earlier views of ICT for development, which only discuss the positive aspect of ICT for development. The first perspective to study the ICT-enabled development is a progressive

transformation which discourses the economic and social progress within different spheres of human activities promoted by giant international organizations like World Bank, United Nations Development Program, The World Economic Forum. The progressive transformation of developing countries depends on effective government, transparency, and responsiveness. The organizations, as mentioned earlier, argue that for the development of a country, it is very much necessary to improve the activities of state organizations, proper delivery of both education and health services, and people's participation in Government (United Nations Development Programme, 2001).

The disruptive transformation perspective examines the unequal effects of ICT on different sections of people within a country. As opposed to the views of the United Nations Development Programme, the World Bank, IMF, WTO analyzed the inequalities of wealth and power in a developing country based on caste, gender, and ethnicity and the different effects of ICT on these different categories of people. According to UN Development Program's annual publication, 'The Human Development Report,' The New ICTs are creating a widening gap between rich and poor and playing the role of an engine of inequality (UNDP Press Release, 1999).

The annual "World Development Report (WDR) of the world bank, the new ICTs, has many positive impacts and includes remarkable balancing possibilities. The World Development Report (1998-99) shows different instances to show the positive impacts of ICTs. The telemedicine, distance education, and falling ICT costs have changed the growth scenario of poor people and emerging countries. Different researchers have restated the dispute between the World Bank-UNDP. It has been attempted to study the conditions under which ICTs can show their equalizing potentialities. To get answers to different critical questions related to ICTs and their impact, the University of Maryland organized a conference on the issue of

growing electronic inequalities. The conference talked over the conceptual issues, models, empirical evidence, significant research, initiatives on IT and inequality, Regional studies on IT policies, future agenda for better knowledge, and better action. The Center for International Development and Conflict Management (CIDCM) conference was inspired by growing social inequality because of the emergence of ICTs and the gap in the availability of reliable knowledge. One of the critical addressing issues of the conference was how ICTs initiate equality and inequality under different conditions in a society. In this conference, some scholars did not discuss the general benefits of IT but also investigated the new technologies' specific capabilities to contribute towards improvements in social value chains, governance, Innovation in social activity, and community and personal empowerment. Obtaining maximum utility from IT in these areas requires policymakers' actions in the public and private sectors. The conference addressed the national and international IT questions (Patterson and Wilson, 2000).

1.2.4 Nature and Design of Post Industrial Organization

The Post-Industrial Society indicates that society's economy is based on the service sector more than the production of goods. This productivity of services establishes relations between persons rather than between man and machine. According to Drucker (1993), the efficacy of an organization in a post- Industrial society is based on the specificity of its objectives and the pre-requisite design to accomplish the goals along with the proper utilization of the information while performing the activities.

“In social terms, the essence of a post-industrial society lies in a new system of values of which the main parts are: a concern for the quality of life as distinct

from mere material advance; a belief in the right of the individual to self-actualization;

an egalitarianism that goes beyond equality of opportunity and urges equality of treatment; and a rejection of traditional forms of power and authority, whether these are personal, familial, or bureaucratic. This value system inevitably forces changes in the structure and function of the various social institutions which make up the total society. Most obviously affected are marriage and the family, the work organization, social classes, neighborhood, and community” (Sadler, 1978).

Modern society can be perceived as an organizational society. While studying the transformation of society by the academicians, the study of the organization, their link with the entire society, their consequences on human relationships, and internal structure and process have become essential topics. Although *organization, bureaucracy, administration* are products of the 19th century, the study on these subjects has a recent origin (Zald, 1998).

Organizations are collectives that pursue relatively specific goals. To achieve particular goals, participants' activities and interactions are coordinated centrally. Goals are specific to the extent that they are explicit, clearly defined, and provide unambiguous criteria for selecting alternative activities. An organization is a collective with a relatively high degree of formalization: its members cooperate "consciously" and "deliberately," and its structure of relationships can be "deliberately reconstructed." An organization's structure is formalized because the rules governing behavior is precisely and explicitly defined. Roles and role relationships are specified independently of the personal characteristics of those who hold the positions (Scott et al., 1998).

The organizations are seen affected by social change in the societies to which they belong. There are two perspectives to look at the relationship between organization and society. One is the influence of society on the organization on the society. The scope of authority becomes less political, legislative and economic environments are directly proportionate to the societal change, and these are movements towards a new way of life, i.e., Post- Industrialism where there is a shift in employment structure. One of the trending concerns of practitioners and researchers of the Post-Industrial society is strategic management that focuses on increasing demands of flexibility, building organizational competence, changing customer requirements, and rapid response to new challenges. These are associated with economic transformation. The traditional view of organization and strategy is to see the organization as a machine that turns resources into products. In Post- Industrial competition, the difference between organizations no longer resides in strategies in the market on either side of the input-output continuum, controlled by an ideal type of hierarchical machine.

Instead, the difference is based on uniqueness as they organize customs and assets and the way they are continuously improving the relationships. As knowledge and technology become dominant social forces, practitioners of every occupation must keep learning despite a significant knowledge base. Rather than rationalization, which results in deskilling, a contrary process occurs where role occupants must acquire more knowledge to recognize and respond adequately to individualized circumstances. Each discovery represents an expansion is required knowledge and, therefore, more outstanding options and more complexity. Hence, the term complexification is used. One consequence is an increased emphasis on human-capital and information systems as the knowledge base in an organization and a change in the relationships between people in response to the growing complexity. People occupy multiple

roles, and their responsibilities and authorities shift, depending on which role is activated and which relationships they are engaged in at each point in time.

There are two kinds of organizational system-the mechanistic and organic (Burns& Stalker, 1961). The organic model is more suited for change and thus more conducive to Innovation (Aiken &Hage, 1971). The 21st-century organizational forms tend to arise in response to social and technological advances (Victor& Stephens, 1994). Post-Industrial society experiences a radically different environment for organizations seen as different from industrial society, and people are shifting from institutional help to more self-reliance in all aspects of their lives (Huber, 1984; Naisbitt, 1982). Post-Industrial-organizational environment demands faster and more frequent organizational decisions to create innovations for external consumption. Organizations require information to decide when decisions and innovations are needed, and decision-makers require information to conclude. Organizations are expected to be more continuous in adopting Innovation.

Modern society is seen symbolizing rationality that helped to produce more with limited resources and technology. Sociologists such as Talcott Parsons (1951), Max Weber (1925) emphasized rationality and its importance for organizational efficiency. With time bureaucracy grew as a basic form of organization that incorporates different groups and their connecting networks, and it started to experience less rational characteristics. The productivity of rational bureaucracy emancipated resources used in the production process and introduced new functions, mainly services, to the common public. The new working class is seen attached to symbolic commonweal services. In the post-industrial era, organizations are based on political bargaining more than rational decision processes. The negotiators gain power from the common public. Organizations have diversified public

service activities. Allocation of resources within and across the organizations is mainly a political process that characterizes the immeasurability of collectively consumed services.

1.2.5 Innovation in an organization and its diffusion

There are micro-level (individual), middle range (organizational), and wide range (society) theories and research design in ICT and society research (Rice, 2005). Researchers have investigated that Information system research in the organization is not embedded in a single theoretical perspective while studying the relationship between information technology, people, and organization. While the Positivistic research technique encourages deterministic explanation of phenomena, the interpretive philosophy of Information System research considers that the social world in an organization is produced, shaped, and supported by a human through their action and interaction. The critical research approach argues that organizations cannot be studied in isolation of the industry, society, and nation within which they operate (Bonald, 1978). Organizational Innovation is considered a new idea or behavior (Robey, 1986; Zmud, 1982) and is concerned with change, and it can be divided into 'technological innovation' and 'social innovation' (Holt, 1971). Technological Innovation is the application of new technology, whereas social Innovation is connected to applying new social patterns of human interaction.

Innovation facilitates organizations to cooperate with the dynamism of the existing competitive environment, market, and customer demand. Innovation in Organization literature shows that it is not only the organization that is affected by the introduction of Innovation but other organizational notions such as job satisfaction, quality of products, performance, knowledge management, adoption of information systems are taken into consideration. The design, implementation, and use of Innovation within a large and complex organization is a social phenomenon that allows individual engagement in the organizational,

operational system (Tohidi & Jabbari, 2012). In the context of the US, economists have claimed that the success of an organization is directly in proportion to the design and implementation of a particular innovation. In the Post-Industrial society, successful Innovation in an organization is the effect of unification of Innovation and informal networks, which are indispensable for adapting and supporting an innovation. Social features of an organization such as culture, norms, values, roles, attitudes of an organization play a significant role in shaping an innovation system. Information system in an organization is an influencer of both social features and practices of the organization. It looks at IT both as the cause and effect of organizational life, emphasizing organizational dynamic and identity. Organizational identity indicates organizational discourse, decision making, and action that differentiates a particular organization from others. Organizational identity comprises the perceptions of the members of an organization, the material features, and the actions. The authors mentioned the term structural duality to define organizational identity. The social structure within an organization is produced and reproduced based on human action and vice versa. It is argued that the organizational identity helps resist change, resulting from internal and external pressure. On this duality of structure, Orlikowski & Robey (1991) have discussed the interaction of information technology and organization. The authors have tried to establish the relationship between structure and action to focus mainly on the creation, use, and institutionalization of Information Technology within an organization. By challenging the debate over the opposition of subjectivity and objectivity, Giddens postulates that while studying social reality, both are equally important. In this study, the authors have highlighted how everyday actions of users and social settings influence a particular technology within which it is approved and applied.

Orlikowski has mentioned four special effects of interaction between Information Technology and organization as Information Technology is the outcome of human action developed and used by humans. Information Technology is also the means of other human action, facilitating the accomplishment of computer-mediated work or communication. Information technology is built and used within a particular social context. Interaction within Information Technology influences the social context within which it is built and used. Information Technology is used, created, and maintained by humans that also enables or facilitates activities of human actors and is conditioned by the organizational stock of knowledge, resources, and norms. Once the technology is accepted, it starts to act upon the institutional structure of an organization either by sustaining it (more typically) or by changing it. The duality of structure explains the links between the subjective and objective dimensions of social reality. Following his idea, Weick (1990) argued that communication technologies are both a cause and consequence of organizational structure. He talks about the dual role of Information and Communication Technology because structure as an ongoing process shapes the meaning of artifacts through scripts, interaction and is itself shaped by those meanings.

Joseph A. Schumpeter termed innovation a discontinuous process that introduces new equipment, firms, and employment structures. Anthropologists H.G. Barnett broaden the idea of Schumpeter and argue that Innovation is the cause of cultural change, and it can be more than only equipment. Any thought behavior that is differentiated from the existing forms can be termed Innovation. Another thinker, Rogers (2003), goes beyond these definitions and suggests that Innovation is a new idea that can be accepted or rejected by individuals depending upon its characteristics. Diffusion is another process through which an innovation disseminates from its source to the users (Robertson, 1967). Diffusion is another procedure of

social and technological change. Several scholars in general and sociologists, in particular, are interested in being engaged in diffusion research during the '20s and '30s. Sociologically, the diffusion procedure incorporates acceptance of new ideas, time, group of individuals who are seen accepting this new idea, the channel through which the Innovation passes through within a particular culture (Levin et al., 1963).

The Diffusion of Innovation Theory developed by Rogers (2003) claims that the innovation process in an organization is seen much more complex than individuals' innovation-decision process. Implementing a new idea does not always follow directly after the decision-making process to adopt a new idea. Implementation in an organization typically involves several individuals, including both champions and opponents of the new idea, each of whom plays a role in the innovation-decision. He has mentioned organizational innovativeness as the dependent variable and throws light on how it is related to some of the independent variables such as individual (leader) characteristics; internal characteristics of organizational structure (centralization, complexity, formalization, interconnectedness, organizational slack, size); external characteristics of the organization (system openness).

In an organization, the process of Innovation is seen passed through different steps-

Perception of the problem: In the first step, a problem must first exist to choose a particular innovation; **The setting of the stage-** reinforcement of the existing circumstances; **The act of insight-** Insight is needed due to the uncertainty involved in the process of Innovation; **The critical revision-**The Innovation is analyzed to determine how practical it is.

The author has also stated that Innovation is regarded as a planned attempt that recombines old Innovation. Based on effects on established patterns, innovation can be classified into – Continuous Innovation, dynamically continuous Innovation, and Discontinuous Innovation.

An innovation may be termed as continuous Innovation if it has little impact on the existing patterns. If it is tried to alter the product rather than establish a new product, it comes under continuous Innovation. The second form of Innovation, i.e., dynamically continuous Innovation, does not alter the established patterns but involves the creation of a new product or bringing changes to the existing product. A discontinuous innovation brings changes to both products and established patterns. The evolvement of Information and Communication Technologies comes under Discontinuous Innovation; if the norms of a particular group favor innovation, the Innovation will be a socially integrated product of the community (Usher, 1954).

1.2.6 Innovation (ICTs) and State/ State Regulated Organizations

A state is a set of institutions and agencies that have the authority to impose binding decisions on members of a society collectively for the sake of their common interests or general desires. This part focuses on how Information and Communication Technologies have a substantial impact on various activities of local, state, and national levels, more specifically, the activities of state-run institutions for the benefit of the people. The period from 1962 to 1977 has witnessed both rise and decline of Post-industrial Society in which there is a shift in value patterns towards a more post-bourgeois aspect of cooperation from saving of economy and competition of the capitalist mode of production. Power has also been changing from traditional elites to agents who are mainly technologically skilled. The coming out of and diffusion of Information Technology is one of the approaches to restructuring the Post-Industrial society where state activities have changed. In the economic sector, the growth of the welfare state emerged with increased involvement in the higher sector, research and development, and corporate planning (Miles, 1985). Power-use of ICT in organizations include internet, intranet, extranet (a type of intranet which is accessed by authorized outside

users, ERP (Enterprise Resource Planning), which is a business process management software within an organization, and other technologies to maintain adequate services and operations in an organization. To define the concept of freedom in society, Ithiel de sola Pool establishes a relationship between electronic devices such as computers, telephones, radio, satellites with the printing press. The scholar has mentioned a two ways cable television system named 'Qube' of the '70s where Columbus residents were seen taking part in a local planning commission meeting. It was counted as the first step through technology people participated in the political system. According to the experts of the information society, the scattering of IT will have political consequences. They say that introduction of IT will include the people into the democracy because through IT, and people will directly engage in voting. The Qube System in Columbus also had another aspect. The votes, Opinions were stored in the computer memory during the two-way communication. Thus, the introduction of technology in a democracy includes different dimensions as one side shows the participatory democracy, and on the other hand, it shows some kind of threat to personal privacy by some persons or organizations. Science incorporates power relationships as in society, and everything is affected by power relationships.

Nevertheless, including power within science does not mean that science becomes less scientific. Early epistemologists and philosophers of science confirmed what science is. Science is thought of as organized institutionally and culturally. If a larger community accepts a discovery, it becomes part of science through the ongoing cultural and scientific innovation process. While talking about the digital divide, it is pointed out that only using information technology in education cannot solve the problem in schools. The relationship between the internet and politics shows the importance of information and communication technology for grassroots mobilization required to bring political change. Unlike the previous

conception on Innovation in organizations, the contemporary idea centers on technology as ambiguous and conflicting. The internalists' perspective has the view that technology plays an independent role that influences humans and organizations. At the same time, the externalist believes that technology itself is a product of ongoing human action, social interactions, and political choices of human actors (Orlikowski, 1991). There is also seen the uneven distribution of the internet through time and space. Technology diffusion is about technological or economic forces, and domestic polity has a huge impact on it. It is also observed that democratic countries are more open to technology and institutional reforms than non-democratic nations. In a democracy, civil society can access 'uncensored information. Goodman et al. (1998) stress the importance of government policy in the diffusion of ICTs. All technological changes are seen creating groups. Milner (2006) has identified two groups- winners and losers and stresses the importance of political institutions accepting or slowing the innovation diffusion process.

Within the field of Science and Technology Studies (STS), 'expectations' in Innovation play a significant role as innovation-diffusion can become considerable as future-oriented activity. Expectations are also associated with guiding activities, providing structure and legitimation, attracting interest, and fostering investment. Based on expectations, roles are assigned, duties are clarified, and precautions are taken to deal with opportunities and risks. The actor groups within an organization are playing a significant role in mobilizing resources for national importance. Based on these expectations, different actors in the innovation diffusion process are coordinated. Studies on organizational politics and power started during the 1960s. The Rational- Bureaucratic model of the study of organization assumes that organization has some specific goals and the basis of the existing rules and regulations, decisions are made. Unlike this, the political model assumes that organizations incorporate goals and objectives

where conflict and negotiations are essential and foremost of the system. By borrowing Berle's idea of power, and described that power is exercised in an organization to utilize the resources to attain a specific goal. The absence of power can make one organization ineffective (Horton, 2003).

Implementation of ICT in government activities, mainly known as the eGovernment, tries to access and deliver Government services to everyday people at the local municipal, state, and national levels. Though different government organizations started to use computing during the 1970s, *governance* appeared in the late 1990s (Gronlund and Horan, 2005). According to the definition provided by World Bank (www.WorldBank.org), "E-Government refers to the use of government agencies of information technologies that can transform relations with citizens, business and other arms of government. These technologies can serve various ends: better delivery of government services to citizens, improved interactions with business and industry, citizen empowerment through access to information, or more efficient government management. The resulting benefit can be less corruption, greater convenience, revenue growth or cost reduction."

Another source United Nations (www.Unpan.org), defines E-Government as "utilizing the Internet and World-Wide-Web for delivering government. Dawes (2009) defines, 'governance comprises the use of Information and Communication Technologies to support public services, government administration, democratic processes, and relationships. The Organization for Economic co-operation and Development [2003, p23] defines "The use of ICTs and particularly the internet, as a tool to achieve better government." The European Union (2004) defines "e-Government as the use of Information and Communication Technologies in public administrations combined with organizational change and new skills to improve public services and democratic processes.

Though different sources have defined eGovernment in their ways, there is a common theme among all the definitions. eGovernment is mainly implementing information technology, especially the internet that aims to provide government services to citizens and businesses and other businesses kinds of government agencies. The introduction of eGovernance started to use information technology in place of traditional paper and physical-based systems. This eGovernment also introduces new leadership, debating, and decision-making strategies, a new method to connect citizens and communities.

In the article E-Government for Developing Countries: Opportunities and Challenges, the author tries to identify and analyze the primary issues, opportunities, and challenges of e-Government initiated by developing countries based on 15 different studies conducted in nine countries, viz. Argentina, Brazil, Chile, China, Colombia, India, Jamaica, the Philippines. Various literature has shown that ICT is an essential tool for the operational efficiency of both private and public organizations. Implementing Information and Communication Technologies within government agencies and departments supports good governance, strengthens the existing relationship, and builds a new one within civil society. (Ndou, 2004). In the words of Tapscott and Caston (1993), "ICT causes a 'Paradigm Shift' as it introduces a new form of network intelligence both in private and public sectors.

Osborne and addresses citizens as customers because through the e-Governance initiative, the government tries to empower everyday people. The term paradigm shift is used because teamwork and participation within a network organization replace the traditional bureaucratic system. The new e-Government paradigm is oriented to user satisfaction. Instead of functional rationality, departmentalization, vertical hierarchy of control, the process is based on horizontal hierarchy, network organization, information sharing. Internal communication is managed by the multidirectional network with control coordination and direct

communication, while external communication is possible through multiple channels and feedbacks. e-Government is a permanent commitment by the government which is cost-effective and efficient delivery of services, information, and knowledge that is useful to improve the relationship between the private citizen and public sector (Chen et al. 2006).

Implementing Information and Communication Technologies in government organizations also have brought changes in the traditional bureaucratic system where information moves vertically and within departments only. Implementing Information and Communication Technologies in government departments can make everything digital and link government information externally which was earlier difficult for people from remote areas to access in the government's offline environment. The application of information and communication technology in government-run institutions can be categorized as (a) decision support to public administration, (b) improving services to citizens, and (c) empowering citizens to access information and knowledge.

Each category requires different technologies and has different sets of critical success factors to achieve the goal. The first category emphasizes upgrading planning and observing development schemes. The second category tries to deliver government services to citizens. It will bring changes in the relationship between citizens and government and make the government activities transparent. The introduction of Information and Communication Technologies can empower rural producers to know up-to-date knowledge about the market condition of the goods and services (Shreekumar and Swecher, 2008).

Basu 2004 has focused on the evolution, progress, and promise of e-government in developing countries. He has mentioned a distinction between internal objectives and external objectives of e-Government. The internal objective focuses mainly on the processes or operations of services, whether the external objectives try to fulfill ordinary people's needs by

establishing interaction with various online services. Basu has identified political stability, adequate legal framework, level of trust in government, economic structure, and government structure (centralized or decentralized) to examine the risk of implementing e-Governance. e-Government initiative by many developing countries was inspired by e-Europe, which was highly politicalized and highly results-oriented tried to track and evaluate every action plan and ask for reviews from the public for further development. (Basu, 2004)

In the article E-Governance in India –Problems and Acceptability, Dwivedi and Bharati (2005) have identified some issues in India like poverty, technical illiteracy, language dominance, unawareness, lack of participation in society, inequality, low level of infrastructure as some barriers to the successful implementation of e-Governance. According to WEF Global Information Technology Report, India ranks 24th out of 134 countries with a 5.38 score in accessing and overall priority of ICT. Therefore, the policymakers in India justify adopting e-Governance as it is cost-effective, reduces waste; therefore, Indian government has been trying to make computers affordable for every section of society. The Information Technology Act (2000) and the Ministry of Information Technology have played a crucial role in facilitating e-Governance in India (Dwivedi and Bharati, 2005). The reform of government administration and improved services to citizens have long been acknowledged as a significant criterion for development, and today's drive towards e-governance can be considered a part of this development goal. Madon has mentioned about two phases of e-governance in India. The first phase is from the 1960s-1970s to the late 1990s, and the second phase starts from the 1990s. In the first phase application of IT was confined only to government activities such as defense, research, economic monitoring and planning, tax administration, etc. The second phase characterizes a paradigmatic shift in e-governance policies that includes IT in different sectors to reach rural and urban areas. He has

adopted a constructivist approach to study the development impact of the e-governance initiative in India (Madon, 2008). He mentioned the works of Heeks(2001) and stated that a 'networked readiness criterion' is necessary as a strategic tool to support access and usage of the technology. E-governance was introduced in India in 2001, but Madon has been working since 1988 on IT projects in India. Madon used Sen's capability approach to assess the relationship between policy discourse on e-governance and how the capabilities of individuals and organizations shape the implementation of these projects.

1.2.7 ICTs and Citizens

According to Rogers (1983), A communication channel connects an individual or a unit of individuals who have knowledge over a particular innovation and technology with other individuals or individuals who do not have experience using new technology. In this case, both interpersonal channels (Face to face interaction between individuals) and mass media play essential roles in creating awareness knowledge of adopting a new technology among individuals of a community.

According to many thinkers, through technology, people experience a sense of connectedness that means they develop some sense of belonging, sharing, and feeling touched. The connectedness may also be developed between individuals who have not met before. One of the most critical theories associated with the study of connectedness is 'Self Determination Theory,' which discusses the ICT use and community or social group context. Self Determination Theory explains the human orientation towards growth, development, and integrated functioning.

The Social Report (2010) states, "Social Connectedness refers to people's relationship with others." It is the connection between people both within their immediate social groups and

into the broader community. The ICT for development paradigm addresses the issue of access, social equity, sustainability, and development of communities in developing countries. The employment of ICT among individuals of a particular community depends upon how responsive they are towards utilizing ICTs to connect communities, their actual needs, and individuals' capability to manage this Technology (Alias, 2013). Introducing new technology into a new local context brings a cultural transfer and mutual learning (Walsham and Sahay, 2006).

Works of literature on the impact of technologies in connecting communities have shown the government's initiative to establish some organization and their approaches to providing telecom and internet services. In India, an organization n-Logue, an operator-assisted kiosk, was set in rural areas to connect the communities. The operator is selected from that area and trained in such a way that using the local language can help the other people of that area (Saith, 2008).

Almost 487 Community Information Centers were established to create IT awareness among people in North-East India, including Assam, by the Ministry of Communications and Information Technology Department of India in 2002. Among various Projects under Community Information Center, one of the essential services is e-suvidha that was offered to apply for government certificates such as birth, death, marriage certificates, licenses. (Chaudhri and Dash, 2007). Another project ASHA, introduced by National Information Center and Assam Small Farmers Agribusiness Consortium, facilitates agribusiness in Assam through a web portal. The first initiative of the Community Information Center was to introduce ICT among the people of the rural areas. The CIC project also promised to implement different government services to the society through the diffusion of ICT (Borbora and Dutta, 2006). For rural connectivity, every kiosk is provided a speaker, camera, internet

connection, and printer to provide mail, chat, browsing. Following the Diffusion of Innovation model, Green (2001) argues that in the case of internet diffusion, many internet users act as opinion leaders to others, introducing them to email, browsing, and other functions of Information and Communication Technologies.

The Millennium Development Goals (United Nations 2009) has the target to remove poverty and hunger. By improving health facilities and education for the poor people can remove the problems. ICTs are thought to be a way through which people may get proper computerized health information systems. Other ICT-based initiatives such as Telecentres have the high potential to bridge the digital divide for the poor (Reelley and Gomez). However, in the words of Warschauer (2003), bridging the digital divide is not only about technology but also about the social, political, and institutional factors that affect people's adoption and use of technology. Heeks and Jagun (2007) say that mobile phones play a crucial role in improving poor people's lives and economic and social opportunities in a developing country. Cecchini and Scott (2003) mention the application of e-Government services and access to microfinance that can reduce poverty.

In a developing country like India, many people have to depend on public health services. Therefore, it is argued that Information and Communication Technologies can provide adequate computer-based health information to poor people. The main aim of policy formulation on Information and Communication Technologies is not about the direct impact of these technologies on land or unemployment of people to remove poverty but to make sustainable livelihood possible (Madon, 2008). Scholars have discussed the issues of both income and non-income poverty in terms of education, healthcare, access to markets.

Poverty can be considered to be the result of two gaps: one the ideas gap and the other, the object gap. Poor people have fewer material goods at their disposal as compared to rich

people. Hence the object gap and ideas gap amplifies the problem. Knowledge goods, efficiently produced and distributed by ICT, can bridge the ideas gap. As primary, secondary, and adult education can address the issue of non-income poverty, and market access is a way to reduce income poverty. United Nations Development Programme (UNDP) has an optimistic view on the role of ICTs for the growth and performance of economics that also create sustainable human development. Poverty is not only about food, lack of material goods, and income gaps. Poverty is also related to social isolation, marginalization, and exclusion. It is about powerlessness. Increasing the nation's overall income, making job opportunities for the rural, and providing efficient service delivery ICT can indirectly remove poverty from rural areas. The direct impact of ICT on poor people depends upon some factors like difference in terms of poor of the 'rich and the 'poor' countries, geographical content, socio-cultural factors like gender, caste generation, etc. Therefore, the main argument by Saith (2005) is in the chapter "ICTs and Poverty Alleviation, Hope or Hype" is that it is difficult to display the transformative capacity of 'Net Knowledge' in removing poverty. ICTs are indirectly benefiting the poor people through link agencies and organizations. To benefit from the non-competitive, welfare-enhancing potentialities of ICTs, the poor should have the motive for emancipatory change.

The central theme of the development studies conference of 2007 was associated with increasing levels of technology usage towards economic and social development.

According to UNESCO 2005, the emergence of knowledge societies may facilitate achieving these four development indicators such as economic opportunities, political freedom, social opportunities, and transparency guarantee.

Information technology and development is an approach that tries to understand the different dimensions of effects of ICT diffusion in developing countries. ICT for development debate

attempts to overstate the impacts of ICTs and the initiative of civil society with a private partnership over the technology diffusion model of state-centric institutions. ICT is regarded as a way of hope as it has raised the educational levels and expanded the market (Shreekuman and Sancher, 2008).

Chandrasekhar (2005), in the article, "ICT in a Developing Country Content: An Indian case Study," argued that ICTs could reduce the global income gap in a developing country like India. As the economic growth of a country may not directly reduce poverty. However, through ICT, people from rural and urban areas can benefit as ICT can promise efficient benefits from different development programs and poverty alleviation schemes.

Warschauer (2003) started with a historical and theoretical framework to observe the affiliation between information and communication technology and social inclusion. He has described three programs of ICT that were initiated in Delhi, Ireland, and Egyptian University. Though these programs were introduced to upgrade the lives of the individuals, but faced many difficulties and could not run smoothly. The problem appeared because the effort was given only to providing new hardware and software systems but not to the human and social systems, which were also necessary to approve a new form of technology. Therefore, Warschauer has given the view that ICT usage is controlled and determined by many factors such as physical, human, and digital, as well as social resources and relationships. To provide a meaningful ICT program, attention must be given to content and language, education, community, and educational structures. Earlier notion of digital divide focused only on computer ownership and internet connection haves and have nots. Warschauer has referred work of Cisler, who argued that the digital divide is not only a distinction between the haves and have nots, but it is a division based on the degree of access to information technology. In his words, the “gap can be overcome by providing equipment

to one that focuses on social development issues to be addressed through the effective integration of ICT".

ICT does not exist as an external variable to be injected to bring about specific results. Instead, it is woven in a complex manner into social systems and processes. From a policy standpoint, the goal of using ICT with marginalized groups is not to overcome a digital divide but rather to further a process of social inclusion. Therefore, it is essential to focus on the transformation, not only the technology.

Social inclusion and exclusion are significant concepts in European discourse. By borrowing the idea of social inclusion and exclusion from European ideas, Warschauer has defined "social inclusion as the extent to which individuals, families, and communities can fully participate in society and control their destinies" (p.8). Many factors such as economic resources, employment, health, education, housing recreation, civic engagement, and culture were considered while discussing social inclusion (Warschauer, 2003).

In the chapter 'Social inclusion: An introduction', published in Social Inclusion: Possibilities and tensions, edited by Askonas and Stewart, Stewart defines, "social inclusion is a matter not only of an adequate share of resources but also of participation in the determination of both individual and collective life chances." It overlaps with the concept of socio-economic inequality, but it is not equivalent to it. There are many ways that the poor can have fewer participation and inclusion even if they lack an equal share of resources. At the same time, even the well-to-do may face problems of social exclusion because of political perception or discrimination based on age, gender, sexual performance, or disability (Askonas and Stewart, 2000)

Warschauer's study is based on empirical research done in India, Brazil, Egypt, China, and the United States. He collected data from ethnographic work and field observations of various technology projects. He stated, "ICT, if deployed well, can contribute toward improved education, government, health care too, and thus be a multiplying factor for social inclusion."

1.3 Knowledge Gap in Literature

The literature review indicates that ICTs were used as a problem-solving mechanism during the inter-war period, mainly in the West. Similarly, non-western societies adopted this technology as part of the modernization process. This is not an exception for India. Nevertheless, there are not many significant works in this area which focus on the cultural, economic, and political factors that shape ICTs for development in India. Additionally, in Assam, different pieces of literature have only focused on its impact on the community as a whole. It is mainly related to economy, agriculture, etc., but few works talk about this technology's social shaping. Also, in the context of Assam, no literature focuses on the role of stakeholders in shaping this technology and their conflicting interests in the organizational contexts. Therefore, this study aims to bridge this gap by incorporating some of the selected government departments to look at how different stakeholders impact shaping these ICTs for the broader development perspectives.

1.4 Statement of the Problem

Sharma (2015), Saith and Vijayabaskar (2005), Saith et al. (2008) examine the growth of IT in India. Using critical social science perspectives on technology and a range of empirical material, these scholars have attempted to look at the impact of Information and Communication Technologies (ICTs) on the users. These scholars have highlighted the diffusion of ICT in the urban and rural lives of people in e-governance. In the debate over

development, three perspectives are pointed out – modernization, dependency, and human centeredness. According to the modernization perspective, the development paradigm in underdeveloped countries is intertwined with the traditional mode of production. Several authors have reviewed how ICTs have been used in National Development and question the potential of the commodity perspective of ICT to contribute the national development. It is also conceptualized as a macro-level influence over infrastructure development, education, and the private sector's development. This one-dimensional perspective fails to locate the individuals' ideas, values, and attitudes over innovation and ICTs. Therefore, social and contextual aspects are essential to see how ICT is conceived. Again diffusion literature focuses on the unilineal perspective on the impact of a particular innovation. It is not s easy to look at the impact objectively. Therefore, this study tries to look at the impact context-specific.

These studies also open up the interaction between activists, technologists, policymakers, and academia from an ICT and social development perspective. Therefore, to examine the Social Construction of ICTs in different governments, the present study goes beyond the existing studies on many grounds. The ICTs in a developing region such as Assam assume greater significance in the context of the conflicting interests of various stakeholders, viz. the state, state-regulated departments, civil society organizations, and the citizens. The existing literature has not given sufficient attention to the social shaping of ICTs within and across government departments in Assam. Therefore the present study attempts to examine the institutionalization of ICTs among various stakeholders engaged in the origin and use of ICTs as it is vital to understand the processes of technology innovation and diffusion. As this study aims to study the social shaping of ICTs in some of the selected departments of the Government of Assam. Therefore, the interests and meanings associated with different

technologies indicate differing perspectives of various stakeholders are taken into consideration.

1.5 Objectives and Scope of the Study

The present study is taken up with the primary objective of examining the implementation of ICTs projects by different departments of the Government of Assam and the engagement of various stakeholders such as state, state-regulated departments, civil society organizations, and citizens in the ICTs design and diffusion process. According to the existing literature on the diffusion of innovation, the diffusion process is more complex than the discussion process among individuals. So it is essential to look at how an organization accepts or rejects an innovation depending upon its values, norms, culture, environment, and individual attitude.

The broad objectives of the present study are as follows.

- a) Explore technology project/s which have been successfully implemented in any department of the Government of Assam;

The government departments are seen implementing Innovation for the development purpose in the form of projects. The objective is to look at how a particular department implements Innovation both in and across the department to change the working culture's paradigm and connect their clients' communities.

- b) Understand the reception of ICTs by different stakeholders, viz. the state, state-regulated departments, civil society organizations, and the citizens;

The social construction of technology perspective looks at how the shaping of a particular technology depends upon the meanings of individuals attached to it. Different meanings are observed based on individuals' ideas, values, and attitudes towards Innovation. As

technology innovation and diffusion incorporate different stakeholders, it requires examining these different perspectives necessary to stabilize the particular Innovation...

- c) Examine the impact of ICTs in different sectors/departments of the Government of Assam.

The diffusion research tends to look at the impact of Innovation in an optimistic way. It was criticized by contemporary researchers who argue that the impact of Innovation can not be assumed before it is applied in a particular context. So, this study aims to look at the impact of ICTs (both desirable and undesirable) on individuals and the organization as a whole that is shaped by several factors of individuals and the organization itself.

1.6 Research Questions

The underline research questions for the study are as follows.

- (a) Is there any technology project that has been completed, and how can these be demonstrated and successfully upscaled? How relevant will it be to the overall development of the state of Assam?
- (b) To what extent are people receptive to the consolidation of technologies? Is it a significant problem with agencies and departments, as well as with communities?
- (c) What are the sectors from which consumers connect through the introduction of technology that can be improved?

1.7 Methodology and Sites of Data collection

The present study uses both primary and secondary data to arrive at the research objectives. As the study is an attempt to look at the conflicting interest of the various stakeholders from a Social Construction of Technology Perspective; therefore, the primary data has been collected by conducting personal interviews with different stakeholders of this emerging

technology, such as producers or the service providers, policymakers, users and the standards such as extension managers and other professionals who deliver services both in rural and urban areas. On the other hand, Collected data has been analyzed by identifying themes.

As this study tries to look at the interpretation of different stakeholders engaged in the ICT innovation and diffusion within and across different departments of the Government of Assam from the STS perspective, particularly from the Social Construction of Technology approach and Actor-Network Theory, therefore, some of the government departments of the government of Assam were selected where different stakeholders can intersect. Therefore, respondents were selected from different categories that comprise Policymakers, Implementers, users, and bystander groups such as extension managers and other professionals who deliver ICT services in rural and urban areas. The study was conducted in ten departments. Among the departments, Assam Electronics Development Corporation Ltd. (AMTRON) plays the role of extending technology and services to government organizations to maximize competitive advantage. The National Informatics Centre (NIC) has emerged as a prime builder of e-government /e-governance applications up to the grassroots level and a promoter of digital opportunities for sustainable development. The other departments are user departments, such-**Department of Information Technology Government of Assam; Assam Science Technology and Environment Council; Guwahati Municipal Corporation; Panchayat and Rural Development, Government of Assam; Office Of The Commissioner, Panchayat & Rural Development Department, Assam; Directorate of Health Services, Assam; National Health Mission, Assam; Department of Agriculture, Government of Assam; and Assam State Seed Certificate agency.** The data collected from the departments as mentioned above comprises diffusion of ICT for the internal functioning of the departments and how these departments are using ICT for improvement of their service

delivery. These departments are proposed to be visited as they engaged in extending IT and communication technologies in health, rural development agriculture etc.; popularizing science among the people; formulating policies on various aspects of science, technology and environment including Information Technology, electronics and internet; promoting IT and IT-enabled services

Among all the organizations, the work management system is based on coordination and supervision methods, and the distribution of tasks is centralized. Each core department has its directorate agencies that implement the policies and schemes introduced by the policy-making departments. The policy-making Departments are situated inside the Assam Secretariat, and others implementing bodies are situated in different parts of Guwahati. A few numbers from the National Institute of Rural Development and Panchayati Raj (NIRD) Guwahati were also contacted as this agency has been working as an ICT facilitator and training provider for the process of ICT diffusion across rural areas. The data collected from the departments mentioned above comprises the diffusion of ICT for the internal functioning of the departments and how these departments are using ICT to improve their service delivery. Among all the organizations, the work management system is based on coordination and supervision methods, and the distribution of tasks is centralized. ICT is perceived as a set of tools that can be used to realize the quality of public services (as a goal) and internal and external efficiency (as a goal and a public value). From a Deterministic perspective, the policy documents have a strong belief and trust in the promises of ICT and have defined ICT as a tool for achieving public service delivery and efficiency. In practice, ICT in public sector innovations is often regarded as a neutral set of tools, in the hand of the right persons and under the right conditions can be applied to enhance the efficiency of public administration. ICT makes it possible to redesign the cogwheels within the government's machinery so that

their functioning and the interplay between them may operate more smoothly and more efficiently to produce more effective outputs and outcomes.

The first research objective is to look at the diffusion of innovation for the overall development of the state of Assam. Therefore, in-depth personal interviews were conducted among policy-making bodies, the implementers, and the users within the departments. The first chapter of the thesis also incorporates different meanings associated with different persons in the ICT innovation and diffusion processes. Accordingly, the samples were selected. The study uses a purposive sampling method to meet the study's objective. All the interviews were conducted in a face-to-face setting in the location of the interviewers' workplace. A semi-structured interview schedule was used to conduct the interviews among the officials of the concerned departments. Questions were open-ended, allowing the interviewee to discuss their views. The interview duration ranged from a few minutes to an hour and very often was interrupted by phone calls and by the entry and exit of various other people into the respondent's office. Such interruptions were considered normal as the respondents were public officials. While entering into an organization, it was compulsory to follow the formal procedure to approach the government officials. It was needed to take permission from the head of the concerned department. Sometimes it was necessary to spend much time asking for permission as the concerned head was not available in the department in most cases. They had to attend meetings, functions, and other official activities as government officials.

Table 1.1 Department wise Distribution of Respondents

Name of the government department	Number of respondents
Information Technology Department, Government of Assam	8
AMTRON(Assam Electronics Development Corporation Ltd.	5
National Informatics Center, Assam State Unit	5
Assam Science Technology and Environment Council.	3
Guwahati Municipal Corporation.	3
Panchayat and Rural Development, Government of Assam	8
Office Of The Commissioner, Panchayat & Rural Development Department, Assam	3
Directorate of Health Services, Assam	3
National Health Mission, Assam	3
Department of Agriculture, Government of Assam	11
Assam State Seed Certification Agency	4
National Institute of Rural Development and Panchayati Raj (NIRD)	2
Representatives of call centers (Health sector)	4
Village Level Entrepreneurs (VLEs)	6
Total	65

1.8 Layout of the Thesis

The thesis is divided into five chapters.

- The first chapter introduces different aspects of the study – review of literature, the rationale of the study, research questions, objectives of the study, methodology, and the structure of the study.
- The second chapter focuses on the emergence of Information and Communication Technologies in the context of cultural, social, and political factors in India and government initiatives on the diffusion of Innovation for the broader development of the nation in general and the development of the entire state of Assam in particular.
- The third chapter captures different ICTs projects adopted by some of the departments of the Government of Assam and their relevance to differing development narratives. Also, it investigates the reception of ICTs by different stakeholders, the state, state-regulated departments and the citizens and the conflicting interests.
- The fourth chapter focuses on the impact of ICTs on different departments of the Government of Assam.
- The fifth chapter summarizes the findings of the study, sheds light on the limitations of the study and explores scope for further research.

Chapter II

ICTs and Development of India: Procedures, Outcomes, and Policies

2.0 Introduction

This chapter looks at the emergence of Information and Communication Technologies in the context of cultural and social factors in India and government initiatives on the diffusion of Innovation for the broader development of the nation and the development of the various regions. Following the Modernization Theory of Development (Anderson and Taylor, 2008) model, India also adopted science and technology to develop the entire nation. Modern science has traditionally been viewed as '*benevolent, apolitical and value-neutral*'. Although there has been consistent political support for the growth and development of science and technology in India, in 'Schizophrenic India' (Bijapurkar, 2007 coined a term; cited in Kumar, 2012) which is a collection of many demographies; therefore, it is paramount significance to look at the growth of science and technology in general and ICTs in particular in terms of long political choices, cultural attitudes and post-colonial history of the nation by *Social Construction of Technology* and *Actor-Network Theory*. Based on these two theoretical approaches, the study would look at many relations and interactions between actors. Here network is treated as relation and translation between the stable actors. Once a network has been established, it implies a sort of closure that prevents other actors or relations from entering the network. It has to be explored in the larger context of science and technology development in India to study the ICT development in India. Interpretation of social and political culture that existed in pre-independent India is also equally important to

know how these cultures shaped future decisions and policymakers, the politics, and resultant technology policies. This chapter will look at how a particular technology is shaped by a combination of individuals, groups, organizations, and practices interconnected to cause change towards a particular purpose. While shaping a particular technology, individuals, groups, organizations, and practices are networks seen as a mix of humans and non-humans with different identities. In "The Information Society: A Secular view," Alistair Black has used the term 'Secular' in a dual sense. The first meaning of secular is not related to religion or sacred thing, which does not relate to religion or religious belief, and is not bounded by religious rule. The second meaning of secular is that which lasts for a long time and goes on from age to age. This article has studied the second meaning of 'secular'. The theories of the information society view that the 20th century has entered a new way of development based on knowledge production, and it is thought that this information society is a characteristic of post-industrial society. However, this secular view of technology has criticized the opinion that information is the element of only post-industrial society. This perspective says that information has been taking different forms at different times. It is only the meaning that has been changing over time. The ancient notion of information was a process.

Nevertheless, now it is an item. Therefore, Black argued that information society could not be conceptualized as a post-industrial, post-modern phenomenon. (Black, 2003). This chapter focuses on India's whole IT development process and how the different networks work for different purposes.

2.1 Science Technology and the Idea of Nation Building in India: Building Route from Colonial Science to National Science

Before introducing modern science (a product of the European renaissance), India also had a rich tradition of science in mathematics, astronomy, medicine, metallurgy. Mashelkar (2008) emphasized the creation, acquirement, absorption, communication, and diffusion of Indian scientific knowledge in the Indian context. He also pointed out that India is seen shifting its positions regarding the field, as mentioned earlier. Although India occupied an advanced class compared to other countries of the world, India experienced a period of stagnation immediately after the Industrial Revolution. Further, he mentioned techno-nationalism as a part of the Indian Science and Technology department that does not support dual-technology and prefers to develop its technologies concerning space, defense, nuclear energy, computer technology, etc. The early Indian initiatives in modern science arose, almost inevitably, in Bengal, particularly Kolkata, which is often described as inspired by a combination of western liberal ideas and traditional Indian values. The development of modern science in India took a new shape after World War II, and scientific research became organized. As a result of the Second World War, the local elite inherited power, and the nation-state was proclaimed as an essential institution. The search for self-determination and national liberation has driven people to build nations throughout history. Taking advantage of the new political environment of the world, political elites reshaped the national identity by using science and technology. Seeing and believing the promise of modern science, the newly empowered elite sought to use it to achieve political stability by addressing the native's needs. Nation-building also emerged due to the cold war, the struggle for national independence, colonial and neocolonial claims of power, and the search for third political ways. Even though nation-building became the way to replace colonialism, there are similarities between

nation-building and colonial rule as they are both emblematic of modern-day development, according to some historians. During the fourth meeting of the Indian Science Congress, the Maharaja of Mysore said that instead of using science for the destruction of human life, it should be used as a medium of peacemaking (The Indian Science Congress, 1917). Although science is international, its recreation is influenced by social and national contexts (Vijayan, 2012).

Modern science and technology in India were introduced during the colonial period by Colonial Government which was used for their interest. After independence, the academicians, political elites, scientific elites saw science and technology as a significant element of Nation Building. Colonial Science is a social practice and an ideology (Kumar, 2012). The intricacies of colonial science are characterized by multiple engagements (Harrison, 2005). Colonial science differs from the non-colonial context. Colonial science is more or less imitative, instrumentalist, and exploitative. Colonial scientists were also seen as fact-gatherers for their purposes. Basallac (1967) [cited in Harrison, 2005] put forward a 'universal model for the diffusion of western science from an initial phase of exploration –in which colonies provided raw data and materials for scientific analysis in the West –through the formal colonies dependence and ultimately to independence. The main aim of colonial science was to explore new locations and locations for imperial development. While talking about the response from the native, the secular modernizers embraced western science, and some of the people tried to relate western science with the ancient texts.

After the end of colonial power in 1945 and the post-World War II era, it was confirmed the ascendancy of the nation-state and assigned legitimacy on local elites. Nation Building became a motto of political elites who sought to take advantage of the new opportunities created by the changing world order to refashion the identities and trajectories of their nations

turned to the transformative potential of science and technology to fill out the contours of imagined futures for self-determination, national liberation, and prosperity. This era was also an emblem of people's quest (Krige and Wang, 2015). Scholars have adopted a post-colonial approach to examine the entwinement between science, technology, and nation-building in developing countries, emphasizing how the periphery welcomes, rejects, or modifies science and technology from the West into ways that provide them with distinct national identities (Beumer, 2018). In the *Midnight Machine*, there is an exploration of post-colonial India's romance with modern technology. After Independence, India relished the birth of democracy, and how India could use technology to catch up with developed economies was among the foremost national concerns of the time. Throughout modern India's history, technocrats have played a central-some, even an outsized role in nation-building, whether Mokshagundam Visvesvaraya, PC Mahalanobis, Vikram Sarabhai, Sam Pitroda, or Nandan Nilekani. Madan Mohan Malaviya, too believed India's future lay in technological and industrial growth. Sukumar (2019) skilfully combines history, science, and politics and examines how the relationship between nations and machines has always been bound up with machinations. Radhakamal Mukharjee (cited in Kumar, 2012) stated that in India, the journey of science began with the disapproval of the country's spiritual and cultural values. In addition to the financial and political obstructions involved, the transfer of technology and science was a representational problem. The British failed to sell science in India properly.

Arnold (2013) states that while studying the post-colonial history of science, it is not so easy to homogenize post-colonial diversity among different countries as they are seen influenced by their indignity and examines Nehruvian science in India as a way of framing the problem of post-colonial science concerning India's scientific standing in the modern world.

Nehruvian Science created a space for post-colonial ownership and subjectivity, establishing the centrality of science in the autobiography of the Indian Nation.

Jawaharlal Nehru in Indian Science Congress 1936 acknowledged that only science could establish humanity (Arnold, 2013). President Dr. S.Radhakrishanan, on 27 May 1964, the day India's first Prime Minister passed away, stated:

Jawaharlal Nehru was one of the greatest figures of our generation, an outstanding statesman whose service to the cause of human freedom is unforgettable. As a fighter for freedom, he was illustrious, as a maker of modern India, his services were unparalleled. His life and work have had a profound influence on our mental make-up, social structure, and intellectual development. It will be difficult to reconcile ourselves to the image of India without Nehru's active and all-pervasive leadership.

While making science a mechanism to achieve national development, it was realized that the development of science for a nation could not be seen as an independent process. A particular society's socio-economic, political structure, and needs play a significant role while shaping science and technology. In Postcolonial India, the institutionalization of science and technology for the broader development of the nation started with the planning of scientific research and included three main components – Politicians, administrators, and scientists. Invited Indian scientists such as S.S.Bhatnagar, J.C. Ghosh, and M.N.Saha contributed to the Post-War organization of scientific research. As a result of the alliance between scientific and political elites, the post-war restructuring process also obtained administrative and material support and scientific and technological infrastructure. The scientific elites became part of the National Planning Committee appointed by the Indian National Congress (INC) in 1939. In 1945, Indian National Congress published its manifesto that declared,

Science has played an ever-increasing part in influencing human activity and will do so in even greater measure in the future. Industrial, agricultural and cultural advance, as well as national defense, depends upon it. Science research is, therefore, a basic and essential activity of the state and should organize and encourage on the widest scale (Mandal, 2010-11).

2.1.1 Growth of IT in the framework of Science and Technology development

In the West, the Industrial Revolution of the mid-18th century was a turning point for the evolution of the production system, through which science developed into a tool for technological advancement. Tyabji (2018) said that scientific and technical development is linear but observed that they influence one another. Besides the Industrial Revolution, the period after World War II can also be considered a milestone for the Scientific and Industrial Revolution (STR). During this revolution, the mechanical model of processing materials was transformed into biological, chemical, molecular, and atomic level transformations. Observing the technological development in India through an institutional structure is the new version of the concept 'National System of Innovation.' As part of the Technology Policy Statement, 1983, self-reliance was emphasized and import substitution.

The national political economy system was considered an important subject to discuss during the independence movement, and the concept of the federal system of Innovation was formalized much later.

Tyabji (2018) addresses three broad categories of technology as the subject of policy and analysis in this article:

1. The epoch refers to technological systems such as information technology, biotechnology, and new materials technology associated with space, atomic energy, and ocean exploration.

2. Another set of technologies that enhanced industrialization was based on building capacity to produce capital goods through public-sector enterprises.
3. The third technology level was predominantly found in the batch processing industries, embodied in the private corporate sector.

Through establishing the cotton and jute textiles and steel industries in India in the 19th century, various research institutions were also created that provided opportunities for scientific analysis of existing technologies.

Tyabji has identified three phases of science and technology development in the post-independence era-

1. The period from 1947s to mid or late 1960s
2. The period from the 1970s to 1991
3. The third period from 1991 to the present.

All the stakeholders involved in the ICT development process are convinced that these new technologies are achieving positive results. ICT application in socially complex and infrastructurally weak environments requires knowledge from multiple disciplines since technology developers are not aware of local operators' local contextual knowledge and maintenance. Parman (2009) examines information dissemination in developing countries from a user-centered perspective. There is a tendency to pay little attention to the history of the development of IT as this is relatively a novel area of study. While conducting a study on the ICT revolution in India, Saith and Vijayabaskar (2005) say that this Innovation's origin is 'idiosyncratic' in nature. Scholars like Dedrick and Kraemer (1993), Parthasarathy (2004), Kapur and Ramaswami (2001) look at India's IT success in the context of outsourcing, offshore software development, and governmental policies. Subramanian (2006) throws light on how the development of IT in India is shaped by the nation's long-term political choices, cultural attitude, and post-colonial history.

The Nehruvian era experienced the linkage of politics, academics, and science, where it was understood that computer technology could be used to collect individual data of the people of the nation and the data of existing natural resources. In the 1960s, India's Government developed policies on software export that led to the development of IT in the country. By establishing Software Technology Parks in the 1970s and 1980s, new approaches to protecting domestic hardware have been devised. Other initiatives by the Government of India to make it a significant source of growth and development include the creation of the National Task Force on Information Technology and Software Development (NTITSD) and the Ministry of Information Technology (Kumar, 2014). After a few years of independence, war broke out between India and China, for which India had to deal with security challenges, and it led the Government to set up an Electronics committee under the guidance of H.J. Bhabha, which has the objective to make a solid indigenous electronics for national dependents and its security. Electronics Corporation of India Limited was set up in 1967, which was insufficient to meet all the local needs in the area of Government, education, and research establishment; therefore, some multinational companies were invited to address these needs. According to Kumar (2014), the ICT sector has grown significantly, emphasizing the responsible factors. Domestic demand of the late 20th century shifted from hardware towards a solution-oriented approach with high investment in human resources and a competitive R&D. The local firms have become more competitive, which has also led to them delivering better service. Nevertheless, Indian identity has become more potent than regional distinctions. Using ICT for development, the Indian state has acknowledged some responsibilities-the growth and development through ICT begins with nurturing this emerging technology supported by the Computer Society of India (CSI), National Association of Software and Service Companies (NASSC), Manufacturer Association of IT Companies and Confederation of Indian Industry.

Furthermore, the state also changed its ICT policy structure. The policies that seek to replace monopolistic state control of ICT innovation and diffusion are the Liberalization Policy of 1991, the New Telecom Policy, 1999, and the amendment to the Telecom Regulatory Authority of India Act, 2000. Research and Development in India have taken a new direction with the arrival of IT. The Centre for the Development of Advanced Computing (C-DAC) at the Indian Institute of Science, National Centre for Software Technology (NCST), was involved in information processing and export. As a part of a government's responsibilities, the author discusses the importance of good governance. Cultural barriers, economic inequalities, intellectual disparities can be reduced, and openness, accessibility, accountability, democratic decentralization facilitate economic and political growth.

2.2 Significance of interaction between Science and Industrial personalities in formulating policies

Social Construction of Technology is a sociological approach towards technology that conceptualizes artifacts through relevant social groups. From this perspective, Innovation is seen as a new combination and new configuration of social practices in some regions of action or social contexts prompted by certain actors or constellations of actors in an intentionally targeted manner with the goal of better satisfying or answering needs and problems than is possible as the basis of established practices. Relevant Social Groups enunciates that technology development is a process in which multiple groups, each embodying a specific interpretation of an artifact, negotiate over its design. Engineers, advertisers, political personalities, consumers, etc., are some of the possible groups engaged in technology innovation and diffusion.

In a study, Wilson and Howcraft (2005) have applied one of the components of the SCOT approach suggested by Pinch and Bijker (1987), i.e. 'relevant social group' in association with

the related notions of stabilization, problematization, interpretive flexibility, which takes a stance against technologically deterministic bias to understand the context in which technologies are displaced. Among different relevant social groups, technology is constructed to answer their problems. Different 'relevant social groups' define a technological problem differently and disagree over definitions of what constitutes success and failure and how evaluations can be used in such constructions. The story of computers in India is closely linked with the development of modern science in India. The initiation of computer technology development and manufacturing in mid-twentieth century India was essentially a sub-theme of colonial rule in 1947. The links- personal and institutional between Prime Minister Nehru and top scientists were essential in setting India on a path to scientific development and in seeding the Information Technology revolution. The growth of science and technology is seen organized in terms of social groups or small communities or growth of professionalization associated with the effective scientific communities. The main aim of *Colonial science* was to collect data regarding individual and natural resources controlled mainly by the colonial Government. Krishna (1991) mentions that a small section of Indian scientists associated with colonial scientific organizations faced racial discrimination. In response to this, a small section of the scientific and political elites set an agenda to fight colonial science and create alternative structures to professionalize and integrate modern science within nation-building. Krishna (1991) identifies three different groups-a scientific groups worked in collaboration with the British Government in the area of education, industry, finance, and science department; another group was engaged in executing specific scientific tasks, and the third category of the scientific community was formed by the scientists who felt alienated by the colonial Government. This group of people that became prominent almost in the 1870s were J. C. Bose, C. V. Raman, M. N. Saha, AshutoshMukerjee, M. L. Sircar, and Visvesvaraya. Sociologically, the three categories of

scientists each had their constituencies, goals, the network of relationships, and scientific programs. The need for a foundation of science and technology development in India began with independence. During that period, H. J. Bhaba and PC Mahalanobis played a central role in establishing research institutes. These top scientists had a link with political leadership, particularly Nehru, who ensured that their projects received the necessary support and attention. Making Science Policy in India is a combined effort by scholars and political leaders rooted in the colonial period. The discourses regarding science and technology can be found in the first Indian Science Policy journal science and launched by the eminent Indian physicist M.N. Saha in 1938. Through this paper, the author has thrown light on Science and Technology Policy cultures in the context of the post-colonial and post-war periods by exploring the key actors, agencies, and institutions that have shaped India's Science and Technology Policy from the 1940s and 1990s. As a developing country, the Government of India spends 75% of total S&T funding on research and development. Therefore, the politics and policies of the Government play an essential role in the decision making of processes relevant to S&T. In the whole process of shaping Science and Technology in Independent India, heterogeneous groups of different actors ranging from politicians, scientists, engineers, academicians, diplomats, industrialists, business representatives, and opinion leaders from the civil society exist. Sondhi (1990) also looks at the development of science in India as a reflection of social and political context and argues that the centralization of political power played a significant role in shaping scientific policies. National Planning Committee was also an alliance between the political elite and the scientific elite. Nehru was the chairman of NPC and Indian scientists- MeghnadSaha, Jnan Chandra Ghosh; Industrialists like PurushattamdasThakurdas, Ambalal Sarabhai; Economists like K.T Shah were part of it who joined in evolving a plan for national reconstruction.

The formulation of scientific policies was based on a series of personal interactions between the scientific elite and political elites. These scientists included Homi Bhabha, S.S Bhatnagar, S.H. Hazer, PC Mahalanobis, and J.G Ghose. India's Atomic Energy establishment was also based on Bhabha's contacts with Jawaharlal Nehru. Mokshagundam Visvesvaraya was an engineer with a social vision focused on the social base necessary for technological development. Another prominent leader, Subhas Chandra Bose, who had ideological differences within INC, also favored using science and technology in India as part of national reconstruction (Mallick et al., 2005).

2.2.1 Ideological disparities among influential elites: Structural considerations

The concept of relevant social groups within the Social Construction of Technology approach has the notion that "all members of a certain social group share the same set of meanings, attached to a specific artifact" (Pinch and Bijker, 1987). Nevertheless, according to Klein and Kleiman (2002), the unproblematic illustration of groups of individuals of the Social Construction of Technology Approach is distorted in nature. According to their study, "The internal structure of social groups may also allow internal factions to embody their particular meaning in an artifact." In the context of India, a Difference of opinion was also observed among members of NPC. As industrialization might solve the problem of unemployment; therefore, the young generation was in favor of the development of science. While Visvesvaraya supported setting up heavy industries for national development, Sahafavored the establishment of academic and research institutions. Another contributor, Homi J. Bhabha, encouraged building primary research institutions. Under his direction, Atomic Energy Commission was expanded to the Department of Atomic Energy. Another prominent Institute, the Tata Institute of Fundamental Research, was founded in South Bombay.

The political and scientific elite were from different linguistic, religious, and caste groups. They were educated in western science and technology in conceptualizing modern science and technology in nation-building. Some common elements guided them- they believed that science could be a medium to attain national development, anti-imperialist and anti-colonialist ideologists. From a historical–sociological perspective, and shaping of science and technology depends upon the interests and ideologies of individuals and the social groups to which they belong (Mallick, et al., 2005; Mallick, 2006).

During the inter-war period in India- intellectuals –educationists, political leaders, scientists, technologists, and engineers could see the potential of modern science and technology as fundamental forces in nation-building. Science and technology activities are seen influenced by social, economic, political, cultural, legal, ethical, institutional, and ideological factors. The interaction took place among different social groups, but their interests and ideologies also influence them within a particular group.

Differences in terms of opinion were also observed among scientists. For Visvesvaraya, only through industrial development could a nation attain economic development. Here, the involvement of the Government is treated as a crucial component. The social transformation was expected to be achieved by new technological and organizational culture. Bose had international exposure, and he could see the link between science and national development. Therefore, he was also in favor of science and its application towards national reconstruction, which according to him, should be located in the framework of anti-colonial nationalism. For that, sufficiently trained human resources (especially abroad) should be made part of the development of science in India.

The notion of scientific establishment through responsible policymaking is not about political influence and concludes by using administrative and scientific means to attain that end. It is

an interactive process among scientists, professional leaders, administrators, and politicians. The ultimate authority is with the politicians, but the initiative is likely to rest with others, including the scientists in or out of Government (Weingart, 1982). The interaction between the scientific elite and the political elite of Post-Colonial India set an agenda to fight colonial science and to create alternative structures to professionalize and integrate modern science within the framework of nation-building. However, differences in opinion were seen among these personalities while adopting science and technology as part of nation-building.

2.3 Institutionalization of ICTs in India: the role of the state

The role of institutions on IT innovation can be understood by applying economic history and new institutionalism in Sociology (King et al., 1994). Government entities are clearly among the most potent institutional forces affecting Innovation (Nelson and Soete, 1988). The role of institutions must be considered an essential component of the innovation theory. The institutional power to influence and regulate can be linked to ideologies governing supply-push and demand-pull approaches to Innovation. The evolution of computers and other IT firms has been marked by heavy government involvement in virtually all countries. Among different institutions, the US Department of Defense and Japan's Ministry of International Trade Industry (MITI) have influenced and encouraged the development of information technologies in various ways, including acting as leading users of IT, supporting research and development, and regulating and providing incentives to the private sectors. Following this, several developing and industrializing countries (NICs) have pursued government policies to promote domestic production and the use of IT. Throughout the 19th century, the British adhered to the view that India urgently needed improvement, a concept rooted in Britain's capitalist evolution. It was thought that India's primitive, technologically inefficient agricultural system was the prime cause of poverty and famine. Government-led

improvement and monumentalism of state works had a lasting legacy for how the British and their Indian Nationalist successor thought about India's technological progress (Arnold, 2013). In India, the state's role in technology development, especially IT development, can be identified by establishing new higher educational institutes, formulating policies, and setting up new committees.

2.3.1 Contribution of Higher education

Although Before independence, a few scientific institutes played a crucial role in the institutionalization of science after the 1950s, the role of institutional structure expanded enormously as a result of the National Education Movement. Bhaba and Mahalanobis started to use computer applications in the scientific program among the prominent scientific personalities. In Indian Statistical Institute, founded by Mahalanobis, introduced electronic calculating Bengal famine to keep statistical records, and his electronic computer laboratory was used for all the governmental activities related to it, and Bhaba used it for nuclear research. In Indian Statistical Institute, the first Indian Analytical Computer was developed. To develop the latest design computer, Mahalanobis also visited Harvard Mathematical Laboratory.

Along with ISI, other institutes of that time such as -Indian Association for the Cultivation of Science, Calcutta; Indian Institute of Science (IISC), Bangalore; Indian Institute of Fundamental Research (TIFR), Bombay and Physical Research Laboratory, Ahmedabad were engaged in setting up their computers, but only Indian Statistical Institutes had its computer HEC_2M, which was quite huge and occupied an entire floor of ISI. Alliance was seen between the US, USSR, and ISI in developing the computer in India. In 1961, the Indian Statistical Institute started to design a second-generation computer collaborating with Jadavpur University that aimed to develop a small-sized computer. Again in TIFR, EAC- 62

was developed by Bhaba in 1965. A debate came up between Mahalanobis and Bhaba. Mahalanobis wanted ISI to be declared as National Computer Centre, while Bhaba wanted TIFR to be declared the same.

As Jawaharlal Nehru declared India as non-alignment, it made an unobstructed path for India to get assistance from the Soviet Union, West Germany, and Great Britain to establish higher technical institutes like IITs in India. There was a dearth of engineering education in India for which some Indians had to obtain engineering education from the Massachusetts Institute of Technology (MIT). In 1944, British Nobel Laureate A.V.Hill visited India and noted the absence of an MIT-type engineering Institute in India. With his recommendation, a commission was established under the leadership of NR. Sarkar. This committee proposed establishing at least four institutes following the pattern of following the model of MITs in different cities of India. As Jawaharlal Nehru was an advocate of science and technology embraced this idea (Bassett, 2009). A shift in the development of technical education was noticed after Independence in India. The Massachusetts Institute of Technology became a model and mentored the rest of the world in the 1960s and 1970s. MIT assisted in establishing two new technical institutes in India to generate engineering expertise essential for the economic modernization of the nation (Balaram, 2011). Higher learning Institutes like IITs and IIMs contributed a lot to India's growth process in the 1960s by producing modern engineers and managers. Among the higher-level education institutes, IIT Kanpur installed IBM 1620 in 1963 during the Kanpur – Indo-American Project (KIAP). IIT Kanpur helped provide early adopters of today's India's biggest IT firms- Tata Consultancy Service (TCS) and Infosys. During the installation of IBM in IIT Kanpur, IIT Bombay got a second-generation Soviet computer Minsk II for its computer center. As there is no 'objective' reality independent of the language (Sarukkai, 2008), and all the manual and technical literature

were in Russian, the faculty members of IITB needed to learn to use the computer. Concurrently, the Department of Electronics (DoE) supported regional computer centers to facilitate commercial users' data processing services and train engineers in programming to establish R&D centers for developing software engineering skills. The UNDP provided assistance to start National Centre for Software Development and Computing (NCSDDCT) at TIFR that focused on practical training in systems software.

An early experiment in networking was conducted by linking up computers located at different locations via telephone lines and doing similar linking up to conduct a one-year post-graduate course in software technology. The experience helped the NCSDDCT launch India's data communication network called the Education and Research Network (ERNET) for the research and academic communities. Although large computers came under various grants and schemes, they also had to be supported locally. Sometimes manuals had to be written, and Indian Scientists and academics conducted training programs.

2.4 Policy discourse and shaping of S&T

The role of government policy for the diffusion of IT in India can be understood in the context of broader environmental factors. India has a long history of policies aimed at technology development. The initial emphasis was on creating a technological infrastructure and providing scientific and technical human resources to the industry and research establishments. The state created several institutions to support technical change within the industry. During the post-independence period, no distinction was made between science and technology policies.

Krishna (2001) has discussed different phases and trends of science and technology policy culture in India and recapitulated the development of S&T policy culture in the context of the

post-colonial and post-war periods by exploring the actors, agencies, and institutions that were engaged in shaping S&T policy. The alliance between the Government's policy and politics plays a crucial role in the decision-making process regarding S&T, as 75% of the total S&T funding comes from Government expenditure. It borrows the idea of Paradigm Shift from Thomas Kuhn, Ruvio (cited in Krishna 2001) different phases of science policy and its shaping by heterogeneous actors such as politicians, scientists, engineers, academicians, diplomats, industrialists, business representatives, opinion leaders from the civil society. In the Indian context, it is observed that there are four overlapping cultures-political- bureaucratic; industry- market; academic and civic which influence framing the goal of S&T policies. These different paradigms have been identified based on development priorities, policy instruments, ethos, and core constituencies of different phases.

The first phase is the phase of optimism experienced in the political-bureaucratic culture. This culture was based on a centralized decision-making process rooted in the Colonial era. Immediately after independence, the alliance between the scientific and political elite shaped the decision-making in S&T in India that can also be observed in current policy culture. The industry-market culture is seen directed by private business and market interest, highlighting liberal policies for technology transfer with import substitution for local firms. The academic policy culture contains the importance of basic research, universities, and academic excellence. Peer evaluation in decision-making dominates this policy culture. Another culture, i.e., civic in policy culture, discusses the contribution of various groups and movements shaping S&T policies for development. The formulation of S&T policies in India goes back to the National planning committee of 1931 where under the chairmanship of Nehru, and it was decided to take S&T as an essential mechanism for the overall development of the state. This phase experienced a powerful influence of Political

bureaucracy and a strong alliance of political elite and elite Indian scientists such as Nehru with HomiBhaba, S.S. Bhatnagar, Mahalanobis, etc. In this phase, it was decided to establish various scientific institutions and agencies with the help of political support. The priorities of the technocracy were combined with those of the politics. Policy instruments were based on state policies, plans, and S&T statements with the main motive of public profit.

The planning commission, S&T ministries, and defense and science councils had core constituencies. Three critical factors determine a nation's prosperity-technology, raw materials, and capital. Technology development is closely tied to the study and application of science. Apart from this, the growth and diffusion of culture to a more considerable extent is possible only because of science. To apply the proper scientific knowledge for obtaining a nation's prosperity, it is also essential to value human resource development. The main aim of scientific policy in India is to encourage, support, and promote science and scientific research in pure, applied, and educational. Science policy in India also stressed its interest in improving people with the help of the application of relevant scientific knowledge. If a country is growing through a raw material crisis, science and technology can provide substitutes. As the developing countries are not self-sufficient in terms of plant and machinery, skilled personnel, and technical consultant, these countries have to spend hefty prices while importing these substitutes. The native people should be provided scientific knowledge and technical skills to be a measure to lessen the gap between developed and developing countries. The Science Policy Resolution of 1958 ensures an adequate supply of human resources with scientific and technical skills and training. The importance was given to these skilled personnel to discover new knowledge in a milieu of academic freedom. During the first phase of the development of Science and Technology, the first computer was

introduced in Indian Statistical Institute, and at that time, India had to depend wholly on MNCs, as India had no local base of computer skills.

The second phase (**the 1970s-1990: Optimism to critical evaluation**), i.e., the industry–market culture, is seen directed by private business and market interest highlighting liberal policies for technology transfer with import substitution for local firms. Economic growth based on technological self-reliance has been one of the crucial objectives of India's planned form of development. During this phase Technology, Policy Statement came into existence. The Technology Policy Statement introduced in 1983 aimed to attain economic independence and reduce poverty by mixing indigenous technology and imported technology. After 30 years of Scientific Policy Resolution 1958, it was seen that India's agricultural system became more potent than before. It also made an industrial base and improved the quality of human resources to some extent. Therefore, The Technology Policy statement of 1983 extended its attention to technological self-reliance.

As India is a diverse country, therefore technology must be introduced so that it suits the local needs and improves the lives of the common people. According to the statement, a nation will be technologically developed by maximum use of indigenous resources. It was concentrated on the employment generation of women and the vulnerable sections of society. One of the technology policy statement's main aims was to develop technologies for export purposes. The energy sector was expected to use renewable resources as much as possible. This policy also emphasized environmental issues regarding ecological balance and improvement of the quality of the habitat. Though this policy was directed to technological self-reliance, it did not imply technological self-sufficiency. The policy must be executed to reduce technological dependence in significant areas. To achieve this self-sufficiency, attention should be given to research and development. Indian space and defense scientific

research were highlighted in this phase, and relative success was observed in the chemical and pharmaceutical industries. India's first science and technology plan was propped to develop indigenous capacity in this phase. This phase faced several challenges regarding institutionalizing new technologies such as microelectronics, Information Technologies, biotechnologies, and their absorption, development, and diffusion. This phase also reflected political instability with frequent government changes until the early 1990s. This industry-market culture did not play a significant role in shaping S&T policy.

The period 1970's and early 1980's witnessed a new direction towards the development of computing in India as the Government emphasized indigenous microcomputer development by establishing firms such as Hindustan Computers Limited Subramanian (2014) has examined the establishment of HCL in the context of the distinctive political economy of India just before the period of economic liberalization and emerging developments in computing technology. Gandhian ideology occupied an important position among the political intelligentsia of the Janata Party. Therefore, Decentralised development and the focus on the cottage, small scale, and rural development dominated the S&T discourse in this period. In this second phase, the Government decided to alter policy and encourage indigenous production to restrict imports.

The academic policy culture contains the importance of basic research, universities, and academic excellence. Peer evaluation in decision-making dominates this policy culture. After that, from 1978- to 1983, he experienced private sector completion due to the liberation of industrial licensing. Then slight import liberalization started in 1983 with the arrival of Rajiv Gandhi as Prime Minister as a computer was his one of the most significant interests. The policy was renewed after 1991 when import liberalization had a partial impact along with other factors such as industrial licensing, overall demand and access to inputs, marketing,

prices, a technological lag, technological standardization, and attitudes toward computers in the private sectors on the growth of Indian Computer Industry. Import liberalization as a policy instrument was seen due to the growing demand for computers during that period. The policy has not been a prime factor affecting technological development, but import policy is a crucial part of government efforts to build an indigenous industry.

In the post- Liberalisation era, New Industrial Policy was introduced, and a corresponding decline in the influence of political –bureaucratic culture in the S&T policy was witnessed. After implementing the scientific policy Resolution 1958 and Technology Policy Statement of 1983, it was decided to combine science and technology with a merged policy. Atal Bihari Bajpayee, the then prime minister, suggests taking science to the people. Science and technology can provide a bright future to the minority of our society. Therefore, importance was paid to the social relevance of science and technology, and accordingly, Science and Technology Policy 2003 was formulated. The new science and technology policy has paid much attention to public awareness of science and technology under the strategy and implementation plan. Public awareness of the importance of science and technology can positively impact daily life, and people will know the direction where science and technology are taking us. People must be aware of the emerging importance of science and technology and its ethical and moral, legal and social, and economic aspects. After the new Economic Policy of 1991, a growing improvement in biotechnology and information technology was seen to a more considerable extent, and it brought interest among people towards technology. To make people more aware of science and technology, it is necessary to make science policies and scientific activities more transparent. Diffusion of scientific knowledge will be possible through the programs like a science museum, planetarium, and botanical gardens as these programs attempt to popularize and promote science and technology in all parts of the

country. There is also a need for programs to promote various national languages to diffuse science.

The development priorities in this era are the importance of basic research, universities, and academic excellence, where peer evaluation and regulation are treated as policy instruments. In this period ethos of scientific research was expressed through scientific and cosmopolitan values. In the civic culture of science and technology, policy development priorities are set by democratic institutions, actors, and processes. Policy instruments are mainly based on public debates and participatory regulations. Democratic/bottom-up/ public goods are prioritized as the ethos of this era, and core constituencies are mainly S&T movements, NGOs, civil society, and its representatives.

Another culture, i.e., civic in policy culture, discusses the contribution of various groups and movements shaping S&T policies for development. Government policies were initially formulated to create a technological infrastructure and provide scientific and technical human resources to the industry and research establishments. Earlier, there was no clear-cut division between science and technology policies. The period 2010-2020 is a crucial decade for Innovation as it has the main aim to unite science, technology, and Innovation together. Innovation in technologies is vital for economic and social development, and understanding the science of technology generally facilitates Innovation. The STI also recognized the importance of engaging with people as the previous science and technology policy documents have done. The new paradigm of the Indian Science, Technology and Innovation enterprise is Science Technology and Innovation for the people. This policy emphasizes the importance of the bond between science and society promoting the scientific temper amongst all sections of the society is identified as a critical element. It further adds 'Triggering changes in the mindset and value systems to recognize respect and reward performances, creating wealth from

science and technology derived knowledge. India has traditionally respected frugality, knowledge over wealth, and wealth-generating mechanisms. Knowledge must be for universal good and need not necessarily be converted into wealth. In the current IPR regime, changing this mind-set is a huge challenge. The policy underscores the importance of public awareness of science by devoting a whole paragraph to the communication of science and technology as reproduced below-

Public understanding of science is an essential dimension for introducing and reaching the benefits of modern science and technology to the people. The civilizational aspect of science or scientific temper needs to be systematically promoted across all sections of society. Using tools such as the national knowledge network, effective science communication methods will be initiated. Public and political understanding of science should be based on evidence and debates with an open mind. People and decision-makers must be aware of emerging technologies' implications, including their ethical, social, and economic dimensions. Thus, the STI has drawn the nation's attention towards the scientific literacy of the common person and decision-makers to ensure the delivery of modern science and technology results to the people.

2.4.1 Developing Computer Policy

A policy framework for the development of computers and information technology and its use in the Government and other sectors had not emerged since the late 1960s. Subramanian (2014) has connected the technology policy formulation with national identity by focusing on the political economy of India starting from India's independence to the 1970s and early 1980s as this period witnessed India's IT history. A socialist focus also influenced IT policy development, and the private sectors were curbed through complex laws, licenses, and permits. Parthasarathy (2004) has mentioned three phases of IT policy development in India

while discussing the state's protection and promotional intervention-the rigid policy restrictions (prior to 1984), eased restrictions (1984-90), and the proactive promotion of the IT Industry (post-1990). Although there was seen a growing demand for computer technology during the 1960s, the state refused to entertain foreign technology due to restrictive trade policies and the importance of the self-reliant domestic industry. A separate IT company was necessary, but due to excessive emphasis on import substitution, priority was given to public sector or state enterprises. With the Government's interest to modernize the Electronics and telecommunication area, a shift in economic policy was seen. Then the period 1970s witnessed the efforts of many top-class science and engineering institutes such as the Indian Institute of Technology (IITs), Indian Institute of Science (IISc), Bhaba Atomic Research Centre (BARC), Tata Institute of Fundamental Research (TIFR), and Indian Statistical Institute (ISI). However, they were not able to manufacture the IT products. Therefore, it was essential to emphasize forward-looking policies such as the Electronics Commission (1971), New Computer Policy (1984), New Electronics Policy (1985), and Indian Software Policy (1986). It was essential to shift the political system from Import substituting strategy to export producing strategy. Those proponents of import liberation argued that technology transfer is essential to modernize India and create wealth. Those against the development of electronics and communication technologies acknowledged that international hi-tech industries might not help the nation achieve its development goal. According to them, lower technology may create unemployment problems in the area of lower technology. Until 1970, two principal manufacturers Electronics Corporation in India and the International Computers India Manufacture, prevailed, funded by public and private enterprises. New computer policy came up during 1981-1989. The economic reform of 1991 created a new path for the IT sector through a series of state policies – the dismantling of the Foreign Exchange Regulation Act (FERA), the New Industrial Policy of 1991, following

state policies to facilitate the IT (including BPO). The National Informatics Centre (NIC) was established during that period to provide IT support to government agencies. During this period, the leaders could see the restrictive policies imposed upon the multinational companies during the 1990s, and policy changed towards liberalizations of economy and technology policies. Other practical and Economic events also shaped the IT policies of the 1990s, such as the economic recession for which the New Industrial Policy was formulated in 1991, and Foreign Direct Investment was allowed in every sector. So it can be seen how almost all aspects of national technology in general and IT development, in particular, were planned and implemented by the Government and supported by government institutions, private entrepreneurs, prime- movers to make IT one of the powerful means to attain national development.

2.5 Foundation of new Institutions and committees

Before independence, several research institutes under Government and Private sponsorship were also established. Some of the prominent institutes are- The Indian Association for the Cultivation of Science, Calcutta (1876); The Indian Institute of Science, Bangalore (1911); Bose Institute, Calcutta (1917); Indian Statistical Institute, Calcutta (1931); Sheila Dhar Institute for Soil Sciences, Allahabad (1936); The Tata Institute of Fundamental Research, Bombay (1945); The Institute of Palace botany, Lucknow (1946), The Shri Ram Institute for Industrial Research, Delhi (1947)(Parthasarathi&Singh, 1992). A.V.Hill, FRS, NL, Secretary of Royal Society, London, was invited to visit India, and he was asked for suggestions regarding scientific and industrial research concerning post-war reconstruction. In the evolution of computers and other forms of communication technologies, there is seen heavy government involvement almost in every country as the US Department of Defense and Japan's Ministry of International Trade Industry (MITI) has influenced and encouraged their

countries that are leading users of IT, supporting research and development, and regulating and providing incentives to the private sectors. Following this development route, several developing and industrializing countries, including India, have pursued government policies to promote domestic production and the use of IT.

A separate IT company was necessary for India, but due to excessive emphasis on import substitution, priority was given to public sector or state enterprises.

The Government of India aimed to establish higher learning Institutes like IITs and IIMs to contribute a lot to India's growth process in the 1960s by producing modern engineers and managers. The need for Information Technology in TIFR and ISI was among the various causes of IT development in India, but these institutes' computer building and computer acquisition activities were not adequate to use for the whole country. A considerable amount of capital had to be generated to spread this Innovation from the research institutes to public use. The lack of a policy framework for electronics and computers was one of the significant causes for generating capital. In the 1962 war with China, India got to know its shortage regarding modern equipment; therefore, the then Prime Minister of India, Jawaharlal Nehru, appointed Bhaba to the National Defence Council to develop scientific research in the area of the Defence force. The committee's objective was to assess the need for electronic equipment in various sectors and identify existing and potential sources of supply. This was the first Government scientists' formal interaction regarding electronics and communications. Bharat Electronics Limited (Government-owned defense production) in Bangalore could make only transmitters and receivers. For that reason, the Indian Defense forces had to depend on incorporated electronics. Instead of collaborating with foreign companies, Bhaba Concentrated on the nation's self-sufficiency in developing computers and electronics had considerable potential for developing atomic energy, defense, and communications. By

observing the growing importance of electronics in engineering, chemical, and metallurgical industries, along with atomic energy, communication, and defense, the Government tried to develop the capability with solid strategies and Defense implications. During the period from 1963-1966, Electronics Committee research centers like TIFR and IST as well as IITs and on the other hand, multinational firms- IBM and International Computer Limited (ICL) were working concomitantly in the development of IT in India. Instead of step by step development of Electronics, the Electronics Committee focused on leapfrogging.

After Nehru and Bhaba, a new electronics Committee was formed under the chairmanship of Vikram Sarabhai. This committee was formed during Indira Gandhi. During the 1960s, the shaping of electronics in India was processed through a conflicting interest between atomic energy and Defense wings which was observed in the working processes of the two sides. In this case, the Defense members of the committee were in favor of importing know-how. At the same time, atomic energy scientists wanted the industry to develop an engineering and know-how base through R&D. In 1967, Electronics Corporation of India Limited (ECIL), a Government of India, entries under the Department of Atomic Energy established by A.S. Rao at Hyderabad to create a strong indigenous base in electronics. When ECIL was formed, Sarabhai wanted it to be a commercial entity rather than the prisoner of the inward-looking import substitution policy of the Government. He believed that export-oriented electronics development would help India close the technology gap within the advanced world.

The Atomic Energy Group established a new India Department for electronics to deal with an issue including industrial licensing. During that decade political climate of India did not support computers and their dissemination so much by the trade unions and left-wing politicians as it was believed that computers could replace human labor. Though public sectors opposed the integration of computers, on the other hand, industries were in favor of it.

As the trade unions opposed the use of computers in their workplace, therefore to negotiate this, a government committee headed by Economist VinayakMahadevDanderkar and according to the report submitted by this committee, the business could use computers for repetitive applications, but only after proper justification and proper approval workers. According to the report of this committee, the state should create computer centers for use by private companies. Such centers could be established jointly with private operators or solely by private companies only in cases whereas government-run facilities failed to deliver. The shaping of this Innovation was based only on an understanding between management and labor unions.

The DoE had the aim to fulfil the development need of the national programs in Atomic research, space, and defense. The department played the role of the developmental, promotional, and regulatory body. The department provided grants to research institutes and IITs in terms of R&D. During the 1970s, Electronics of India Limited provided the necessary computers to the Department of Atomic Energy. The Systems provided by ECIL were not to address the commercial purpose.

After that, the National Informatics Centre was created to meet the informatics and computer application needs of the central government departments and state governments. National Centre for Software Development and Computing Techniques (NCSDDCT) was later named National Centre for Software Industry to develop software techniques and train software technologists. States were encouraged to establish Electronics Development Corporation, which triggered industrial activity in many of them.

Computer multinationals entered India when designing computers for the first time. IBM started its operations in India through a marketing and support office in Calcutta in 1951. After two years, a card manufacturing in Bombay was established to manufacture the

necessary punched cards for IBM. When IBM WTC chairman Arthur K. Watson visited India in 1959, an agreement to take up manufacturing in India was signed between him and the then Prime Minister of India.

Another state's role was to establish new institutions such as Indian Telephone Industry, Bharat Electronics, Ltd, Hindustan Teleprinters, and Hindustan cables. The electronics committee and a separate Electronics Department were set up. Again 1983, social tariffs and tax concessions to electronics firms show how polity and economy played significant roles in making Electronics and Telecommunications a part of the development process (Sharma, 2015).

2.6 Institutional support over IT development

Since the 1950s, the institutional structures for pursuing scientific objectives have expanded enormously. Before independence, in the institutionalization of science, scientific institutions like the Delhi College, Aligarh Scientific Society, Bihar Scientific Society played a crucial role. In the Colonial period, scientific research was concentrated mainly in universities and industrial laboratories to develop equipment for the wars. In 1939, a Scientific and Industrial Research Board was established following the British Scientific and Industrial Research (BDIR).

The institution of science was established due to the Nationalist Education Movement. At that time, necessary equipment was limited for the laboratory only to glassware, microscopes, mathematical instruments, and analytical balances. There was an alliance between firms with Indian Tata and Steel Company.

After Independence, Nehru and contemporary scientists like Mahalanobis and Bhaba pioneered science policies in India. During the era of Nehru, the country embraced foreign

technology and capital. Multinational firms like IBM became a dominant player in the Indian Completing Industry from 1950 to 1977. Mahalanobis and Bhaba started to use computer applications in the scientific research program.

P. C. Mahalanobis founded Indian Statistical Institute in 1932 that developed mechanical, electrical, and electronic calculating machines in India.

During the Bengal famine, PC Mahalanobis was asked to give an overall estimate of the statistical record. However, Mahalanobis established the Indian Calculating Machines and Scientific Instrument Research Society in September 1943 to manufacture, assemble, repair, purchase, sell, or deal in calculating, mathematical and scientific instruments and accessories. All calculations machines were merged under the umbrella of an electronic computer laboratory. Gradually, the technology had progressed from calculating machines to computers. The first Indian analytical computer did all the activities manually, so it took a long time to solve linear equations.

It became difficult for ISI to compete with IBM regarding their quality as there were basic facilities such as electroplating. Mahalanobis concentrated on developing the latest design of digital computing by visiting laboratories like Harvard Mathematical Laboratory and meeting specialists of these fields from various places. Mahalanobis developed digital technologies closely linked with both sociologists and the western world. Among the various institutes of that time – Indian Association for the Cultivation of Science, Calcutta; Indian Institute of Science (IISC), Bangalore; Indian Institute of Fundamental Research (TIFR), Bombay and Physical Research Laboratory, Ahmedabad was engaged in setting up their computers, but only Indian Statistical Institutes had its computer HEC_2M, which was quite huge and occupied an entire floor of ISI. The development in design continued to add more computing power to speed up. The early stage of the development of computer technology was possible

with an alliance with a foreign country. IST imported equipment from the Soviet Union, and the Soviet equipment was funded by the UN and supervised by Americans. Therefore, it was more or less Soviet- American Cooperation at ISI. After that, it was started to develop an Indian Computer. In 1961, ISI initiated a joint project with the newly established Department of Electronics and Communication Engineering at the Jadavpur University to design a second-generation, solid-state transistorized computer. The idea was to develop a small to medium-sized computer that was fast and versatile yet cheap enough to be fabricated.

The growing interaction between Nicholas C. Metropolis (Director of the Institute of Computer Research at the University of Chicago) and Mahalanobis gave birth to Second-generation computers in India. This kind of development activity progressed in Bombay also at the Tata Institute of Fundamental Research (TIFR). Bhaba founded the Centre in 1945 with funding from the Sir Dorabji Tata Trust, run by the House of Tatas. In the Second World War, Bhaba was in India, and for the first time, he proposed a need for research on nuclear energy as it was believed to be a significant source of electric power in a couple of decades. For the study of nuclear energy, Bhaba was looking for skilled personnel on modern instrumentation and computers. EAC-62 was an outcome of Bhaba's research, and ten units of this computer were delivered to different research institutes and engineering colleges by 1965. TIFR was also one of the institutes that developed computers.

Then gradually, a need developed to build more robust, standard, commercially available computers to meet the computing needs of their respective research groups. A debate came up while deciding National Computer Centre. Mahalanobis wanted ISI to be the national computer center, while Bhaba wanted TIFR to be declared the same. Among the Indian higher-level education institutes, IIT Kanpur installed IBM 1620 in 1963. IITs were established following the pattern of the Massachusetts Institute of Technology. Before

independence, India had some of the finest institutions in science, such as the Indian Institute of Science, Bangalore, and Tata Institute of Fundamental Research in Bombay.

Nevertheless, at that time, engineering education was pathetic. Colonial-era engineering education was designed to produce civil engineers and overseers employed in irrigation, public works, and railways. The demand was changed after independence, and India needed a diversified technical workforce trained in a range of modern disciplines for employment in sizeable state-funded development projects and private industries. The first IIT was established at Kharagpur in 1951. Nehru wanted MIT and its direct involvement in making IITs one of India's leading educational institutes.

IIT Kanpur was developed due to direct interaction between the Indian Government and the American Society for Engineering Education. The American Society for Engineering Education submitted to the Government of India on how engineering education could be developed. IIT Kanpur got its first IBM 1620 during the Kanpur Indo- American Project (KIAP) initiated in 1961. At that time, IIT Kanpur did not have its department of Computer Science. Many business firms and corporations also used the IIT Kanpur computer for commercial data processing. Faculty members, encouraged to take up consultancy assignments with industry, made their first contracts with newly set up software firms like Tata Consultancy Services (TCS). The need for Indian Textbooks on Fortran Programming, Numerical Techniques, and Digital Logic increased.

Around the time IIT Kanpur got the IBM machines. IIT Bombay got a second-generation Soviet computer Minsk II for its computer center. All the manual and technical literature were in Russian. Therefore, faculty members of IITB had to learn to use the computer. Parallel to the growth of computer science education in the IITs, the Department of Electronics (DoE) supported regional computer centers that provided data processing services

for commercial users and trained engineers in programming, intending to establish R&D centers for developing software engineering skills. The UNDP provided assistance to start National Centre for Software Development and Computing (NCS DCT) at TIFR. NCS DCT focused on practical training in systems software.

An early experiment in networking was conducted by linking up computers located at different locations via telephone lines and doing similar linking up to conduct a one-year post-graduate course in software technology. The experience helped the NCS DCT launch India's data communication network called the Education and Research Network (ERNET) for the research and academic communities. Mahalanobis and Bhaba got involved in computer development activity early on. Both did so to advance their respective areas of scientific research – Mahalanobis for analysis of statistical data and Bhaba for nuclear research.

Since large computers came under various grants and schemes, they had to be supported locally. Sometimes manuals had to be written, and Indian Scientists and academics conducted training programs. A policy framework for the development of computers and information technology and its use in the Government and other sectors had not emerged since the late 1960s.

2.7 Embracing foreign technology and conflicting interest: a case of IBM

In a study, Cortada (2013) used Roger's diffusion of innovation model to look at how the diffusion of Innovation, primarily digital technologies, possibly treating computing, related devices with it as one general class of technology. According to him, a nation's economic circumstances affect the adoption of a particular technology along with the technology's unique characteristics. Other essential elements such as social and legal environments are

also crucial to IT adoption. Here, laws generally govern the contracts regarding IT, its protection of patent and copyright (both hardware and software), and the educational system to provide skilled personnel for the appropriate utilization of the Innovation. In the diffusion of IT, knowledge in a developing country like India Multinational companies also play an essential role. Some prominent business historians such-Tirthankar Roy (2014) Tomlinson (1978), studied trading firms in India in colonial India and post-colonial India. Immediately after independence, Prime Minister Jawaharlal Nehru released a policy statement on the entry of foreign enterprises in India where it was stated that foreign firms would be appreciated for the national interest for a limited period. Grieco (1982) used two significant schools of thought- 'Bargaining School' and Marxist Dependencia School- to study the relationship between developing countries and multinational enterprises, focusing on India's experience. The Bargaining School aims to understand under what terms and conditions the multinational firms operate and how they negotiate with the host country. In this context, it is observed that although the host countries have control over the market and resources, the MNEs have more control over capital, technology, and managerial enterprise. The Marxist Dependencia School sees these international firms as a form of capitalism where the real power resides outside the developing countries. IBM, a well-known company in technology, with emphasis on computer science and engineering and associated fields, became a dominant player in the Indian computing industry from 1950 to 1970. Such outside companies faced specific problems regarding non-convertible currency, obtaining licenses, and permits.

Another difference of opinion was observed between IBM and the Indian Government in terms of purpose. IBM started its operations in India through a marketing and support office in Calcutta in 1951. After two years, a card manufacturing in Bombay was established to manufacture the necessary punched cards for IBM. When IBM WTC chairman Arthur K.

Watson visited India in 1959, an agreement to take up manufacturing in India was signed between him and the then Prime Minister of India. The host country government tries to achieve its goal for national development, whereas IBM responds to the host country's policies based upon its bargaining strength relative to the host country's Government. The conflict between India and IBM arises due to the disparity between the policy formulated by the Indian Government and the response mode of the multinational corporation. The relative bargaining strengths of the host country government and the multinational corporation depend upon their control over the market, natural resources, human resources, capital, and technology. The potential for prolonged conflict and eventual divorce comes with an equally high degree of relative bargaining strength between the host country and the multinational corporations. Studies have shown that equity participation, control by local national, and transfer pricing are among the significant conflicting issues among multinational corporations and nation-states. In contrast, political interference and socio-cultural norms within the host countries are seen as less important. According to the studies on multinational corporations and host countries, economic issues of equity participation, management control, expansion of exports, reduction of imports, and use of local inputs have been assumed as primary sources for tension and conflict between multinational corporations and host countries.

2.8 Political Environment that shaped S&T development in India

Political Environment also played an essential role in shaping science and technology in general and Information technology in particular. The political environment of various phases influenced the IT policy culture.

Under the dominion of the Congress party (1947-1977), the public sector played a crucial role in the economy. The centralized economy existed during this period. Capital, the industry was controlled centrally. The policymakers focused more on the issue of

employment concerning the use of computers in an organization. According to Dandekar Committee 1972, computers were introduced in banks, insurance companies, and many private companies. The public Accounts Committee which was formed in 1975, held that computers in various sectors could bring economic growth only in the long run. According to this committee, the introduction of computers might cause large-scale unemployment in a developing country like India. During this period, different rules on imports were imposed during the 1970s. The political event that played a vital in the development of the computer in this period was the war between India and Pakistan. India had to be self-sufficient in electronics and computers as the USA supported Pakistan. Therefore, the Department of Electronics (DoE) and the Electronics Commission (EC) were responsible for making policies. MGK.Menon, the Secretary of the DoE and Ex -Office Chairman of EC, was in favor of manufacturing computers for the defense and security of the country. It was an essential requirement to upgrade the capability to design and manufacture computers locally. When it was realized that producing computer equipment locally was not an easy task, a demand to allow private companies to manufacture computers was observed.

In this phase, the computers which ECIL produced were seen used only for government purposes and in government institutions. These could not compete with the existing markets as ECIL did not develop the necessary software. Changes in technology were also an essential feature of this phase. Upgradation was noticed in TDC 12, which transformed to TDC 312 using transistors. NCDC, National Informatics Centre (NIC), Funding Army Radio Engineering Network (AREN) were formed during this phase.

The period 1978–1990s experienced the entry of private enterprise in computing. Here, the then Prime Minister played the role of opinion leader under whose guidance private enterprises could manufacture computers in India. One of the consequences of their

initiatives was witnessed in terms of the number of computers that went up to 80000 in 1990 which was 1000 in 1978. In this phase, India experienced exponential growth in software growth. Along with the political factors, the Brain Drain of IIT graduates to the USA during the '60s and '70s enabled software companies to get a favorable position in the USA software development market. The author has described this 'Brain Drain' to UAS as an opportunity to gain in the 1990s.

ISO and IEC formed the Information Technology Task Force in 2000. Although India adopted different initiatives for the diffusion of ICT, it was lagging in telecommunication equipment compared to the rest of the world. Within the country also, different states went through different experiences.

The Government adopted various guidelines to diffuse computers. Among them, some were most noticeable such as dissemination of computer education in a higher educational institute, focusing on human resource development in the IT sector, promoting software exports, programs in computer-aided design, computer-assisted Management Programme, establishing software technology parks of India, use of the electronic voting machine.

When it was realized that IT is identical with communication, then the Department of Electronics was merged with the Ministry of Communication to create a new ministry of Communication and Information Technology. Private enterprises were allowed to enter this field by announcing a new telecommunication policy (Sharma, 2008).

2.9 Influence of Political and Economic factors over IT policy

Modern politics in India, up to now, were dominated by the desire to gain independence from the British and then to remain independent from the significant superpowers during the cold war. Since Independence, India has followed a generally socialist economic policy within a

democratic political framework. However, in 1991, the new Government of Prime Minister, PV Narasimha Rao, instituted several market-oriented reforms to move India from its socialist orientation.

The IT policies of the period 1980s were designed by partial liberalization guidelines, which also tried to enhance the modernization of an IT industry. Two major policy initiatives on IT development were announced during this period-

- a) New Computer Policy of 1984- This hardware policy was announced by DoE to support the use of computers for economic and social development by promoting the manufacture of computers based on the latest technology, at prices comparable to international levels, and with progressively increased indigenization.
- b) 1986 Policy on Computer Software Export, Software Development, and Training – This policy was also announced by DoE with the objectives to promote the integrated development of software in the country for domestic as well as export markets and to promote the use of the computer as a tool for decision making and to promote appropriate applications that will accelerate economic development.

To promote the IT industry, several programs, initiatives, and institutions were established to implement policy and promote various aspects of IT through research and development, IT networks, IT use, Government procurement, and IT skills.

In terms of formulation of IT policy, it has been observed that it focuses heavily on regulating foreign and domestic markets. The policies chosen in the past have been driven more by broad political and economic considerations than by a desire to diffuse IT use and production broadly. The heavy emphasis on self-sufficiency was related to ideological and security concerns, while the 1980s push for software exports was primarily due to the balance of

payments concerns (Dedrick and Kraemer, 1993). Mani (2004) has mentioned the most extended history of government intervention as a significant weakness of technology development and manufacturing. There since 1991, the manufacturing sector in the country has been undergoing a wave of liberalization, the main objective of which is to reduce both external and internal barriers to entry. A significant reversal of past policies has marked the recent policy approaches. India of the 1980s is vastly different from that of the 1950s. There is indeed a need for rethinking for reshaping past approaches.

2.10 Diffusion of ICT to other regions

Technology diffusion in the domestic market progressed slowly. In the first phase, it was confined to scientific, academic, and research institutions that brought an indirect impact on the common public of the nation. The second phase of IT application in India is diffused to government services. As digital technologies grow, they become omnipresent in schools, small businesses, and middle-class Indians (Sharma, 2015).

The post-liberalization period experienced an uneven growth pattern among different states of India. This unbalanced economic growth was a continual problem. From a Technological Determinism perspective, scholars expected ICT as a means of national and the development of the states. They favored investing in ICT to improve economic growth and generate more employment. After the economic reforms of 1991, it was suggested to reduce governmental control, and following this rule, the other parts of the country allowed private investments in the ICT sector in ICT manufacturing and ICT services (Mallick, 2012). Unlike the central government policy initiatives that focus on reducing or eliminating import duties on IT products, relaxation of norms concerning inward and outward investments, and foreign exchange related to computer technology, the policy initiatives were taken in terms of subnational level highlights their unique features. Andhra Pradesh, Karnataka, Tamil Nadu,

Delhi, and Maharashtra were some of India's early adopters of IT. In Karnataka, Electronic System Design and Manufacturing (ESDM) policy 2012 aims to make this state a preferred destination of investment in ESDM and encourages the export of electronic products. On the other hand, Andhra Pradesh aims at improving governance in the state using ICT. In the context of Gujarat, it was observed that the Electronics policy for the state of Gujarat (2014-19) wants to attract FDI and the latest digital designing technology. West Bengal wanted to make the state one of India's three top IT states. Maharashtra government took a decisive step towards accelerating investment flow to the underdeveloped region of the state and creating IT parks and a particular focus on attracting BPOs towards rural and semi-urban areas. According to Rogers (2006), leadership has always been a critical determinant of the successful adoption of Innovation.

Similarly, under the guidance of Rajiv Gandhi, who was a promoter of the use of ICT in the social and economic context of India, he decided to make it a part of Government agencies as a replacement for a paper-based method of communication. The National informatics Centre played a huge part in establishing a connection between central, state, and district levels. E-Governance in India is a journey from computerization of Government to all tiers of public administration, and these fragmented levels are incorporated under the National e-Governance plan (Prasad, 2012). These e-Governance projects have included infrastructure development, policy change, capacity building, and private sector participation to mark ICT as a paradigm shift in development practices.

2.11 Conclusion

Studies on STS have pointed out the interdependency of science and politics in a particular setting, and it is the base for the normative order of society. In the chapter, it was attempted to look at the development of science and technology in India in general and ICT

development in particular by focusing on the entwinement among policy development, interaction among engaged actors, political events, and changes in the economic structure of the society applying Social Construction of Technology (SCOT) approach and Actor- New Theory (ANT). The aim and objective of science and technology towards time and these changes cannot be studied in isolation. In this study, ICT as an actor has to achieve strength by establishing interaction with different institutions of the country. Modern science and technology in India were introduced during the colonial period by Colonial Government which was used for their interest. After independence, the academicians, political elites, scientific elites saw science and technology as a significant element of Nation Building. The early Indian initiatives in modern science arose, almost inevitably, in Bengal, particularly Kolkata, which is often described as inspired by a combination of western liberal ideas and traditional Indian values. The development of modern science in India took a new shape after World War II, and scientific research became organized. Scholars have adopted a post-colonial approach to examine the entwinement between sciences, technology, and nation-building in developing countries, emphasizing how the periphery welcomes, rejects, or modifies science and technology from the West into ways that provide them with distinct national identities. The growth of science and technology is seen organized in terms of social groups or small communities or growth of professionalization associated with the effective scientific communities. They were also influenced by their ideologies and interest and their academic field in this process. Studies have shown that IT in India is also shaped by the nation's long-term political choices, cultural attitude, and post-colonial history. The development of computers and electronics started in academic institutions in India, and its development cannot be separated from political-economic influences. There was a growing demand for computers in the 1960s; therefore, the Government depended upon the contribution of higher educational institutes. Nevertheless, their contributions were confined

to the institutes only. Therefore, policies had to be modified according to the nation's needs, and the state welcomed the outsider companies. As both the nation and the outside companies had their interests and profit motives, the period from 1970-80 also experienced conflict among the two categories. Building institutions, forming new committees, changing policy structures are some of the crucial contributions of the state while trying to make ICT a means of development practices. One of the SCOT approach components focuses on the engagement of different groups of people. The development of science and technology in general and IT, in particular, is also a result of interaction between different groups of people where these people are influenced by their ideology, interest, and socio-economic background. The implementation of computer applications was confined to academic research institutes at the first phase. Later it moved to business, government services, and middle-class families. The National informatics Centre played a huge part in establishing a connection between central, state, and district levels. E-Governance in India is a journey from computerization of Government to all tiers of public administration, and these fragmented levels are incorporated under the National e-Governance plan (Prasad, 2012). These e-Governance projects have included infrastructure development, policy change, capacity building, and private sector participation to mark ICT as a paradigm shift in development practices. Although the state policies were formulated to establish equality, there is a new form of inequality with this new technology- the digital divide. The disparity is seen in terms of regions. While some states are early adopters, others lagged in the ICT diffusion process due to their regional differences, policies, etc. Globalization is the name of integration not only seeks a new configuration of the international system but also tends to influence the traditional role of the Westphalian sovereign state. Traditionally, the state consolidates different groups in society through its regulative, distributive, and coercive powers. It acts as a judge, jury, and executioner. It determines the economic and social policies to maintain a

working balance between competing groups in society. As Globalization proceeds, state roles and structures experience significant transformations. Weberian bureaucracy is becoming New Public Management (NPM). To address the issue of governance and sustainable development, especially in developing countries, two of the main concerns, Global Democracy and Global Governance of the 21st century seen forcing governments around the world to provide different sorts of policymaking frameworks to meet the universal requirement of good governance. The Information revolution presented unprecedented governance challenges for national and international political systems. Fast-changing information technologies are likely to continue to affect the development paradigm, the organization of society, and how government structure operates. The response of the policymakers and the bureaucrats to this new technology should be of great interest and concern to all citizens in all parts of the world.

Diffusion of ICTs, Stakeholders and Conflicting Interests

3.0 Introduction

This chapter aims to look at the Information and Communication Technology projects, which have been successfully implemented in any department of the Government of Assam. Science and technology studies focus on how society and technology interact and the role of social elements in technological change. Though technologies may have a social and economic impact, they also have social context-social factors which shape their development. This chapter of the thesis deals with the social embeddedness (Avgerou, 2010) of various Information and communication technology projects implemented by different departments of the Government of Assam. This chapter examines the shaping of ICT innovation and its diffusion within and across organizations, especially in Government organizations concentrating on creation, use, and institutionalization within a particular social context. Applying Roger's Diffusion of Innovation model (Rogers, 2003), the chapter will look at how, why, and at what rate new ideas of ICTs spread in a particular department. Adopting innovation in an organization is more complex than individuals adopting it. Organizations mainly adopt many innovations, and in most cases, individuals can not adopt a new idea until an organization has previously adopted it (Rogers, 2003). The ICT innovation has been introduced for the broader socio-economic development of the state of Assam through some government projects and new schemes. ICT services have been delivered among individuals

through government organizations or link agencies. Some services are introduced only for a single purpose. On the other hand, some are sustained for a more extended period depending on their need. The constructionist perspective identifies that technological elements alone cannot explain technology development nor use (Pinch and Bijker, 1984).

Nevertheless, technical and social factors are intimately interconnected (Woolgar, 1996). It is through the interaction of technical and social factors that technologies develop. Therefore, Hughes (1986) describes this as an interactive perspective that offers that all components that exist in technological development share the same status, and technology includes different dynamic elements. As pointed out by Hughes (1986), this approach represents the 'seamless web,' which discusses the multiple determinations of technologies. Within organizational studies, the socio-technical systems (STS) perception was one of the leading claims for considering the interaction of social and technical factors to improve administrative processes (Emory and Trist, 1961; Mumford, 1983).

This thesis chapter also deals with the second research objective that focuses on the reception of ICTs by different stakeholders, the state, state-regulated departments, civil society organizations, and the citizens. Stakeholder theory focuses on who is engaged in decision making and who are benefitted from such decisions. Freeman (1984) defines stakeholders as 'any group or individual who can affect or can be affected by the achievement of the organizations'. The public management literature emphasizes the need for change based on the continuing exchange of ideas and greater participation (Fooman, 1999). The conventional idea of stakeholders implies it as a group of individuals independent of their own; they may compete against each other or complement each other. Besides this, stakeholders may form associations among them that may influence each other, which is crucial for a particular organization to play its role. In this study, it has been observed that while implementing a part

of both inter and intra-organizational activities of the Government departments, multiple entities such as state, state-regulated departments, civil society organizations, and citizens are engaged. One of the critical elements of the Social Construction of Technology approach (SCOT) is *relevant social groups*. These groups are closely connected with an artifact, and each group attaches a particular meaning to the artifact. These groups are seen similarly defining a particular innovation. A technology frame within which these groups have interacted with each other, and this particular technological frame shapes their thinking and acting towards the technology (Bijker, 2010). The constructivist approach to technology was initially confined to studying the shaping of technology from the creator's point of view, and later its extensive idea focuses on the role of users or consumers in shaping technology. This study attempts to look at the conflicting interest of the possible involvement of stakeholder groups, for instance, producers or the service providers, policymakers, users, and the bystanders such as extension managers and other professionals who deliver services both in rural and urban areas those who are engaged in ICT innovation and diffusion of some of the government departments of Assam. According to Rogers (2003), adopting a particular innovation in an organization faces more tension for change than the individual as an organization is an aggregate of different actors and the organization's structure with intrinsic procedures and rules and regulations. Depending upon the attributes of a particular technology, it may be accepted or rejected. As SSK treated both success and failure of technology equally important, this study would look at the adoption and rejection of ICTs among different stakeholders and identify the different degrees of adoption among these stakeholders. The chapter is divided into four parts to look at diffusion patterns among different stakeholders such as state, state-regulated departments, involvement of civil society organization, and meaning assigned by a citizen while adopting this technology.

3.1 Stakeholder Theory in Information Research

The origin of stakeholder theory is found in the management literature, and it is an integrated approach in studying organizational innovation systems as it indicates the connection between organizations setting socio-political arena. Different studies have depicted the term 'stakeholder' differently. Some studies stress the legitimate claim of groups over a particular organizational setting, while others focus on the joint venture of different groups who generally work to achieve a common goal. One of the prominent scholars of Stakeholder study, Freeman (1984), divided stakeholder groups into internal and external. The internal group incorporates customers, employees, suppliers, owners, whereas the external groups are mainly governments, competitors, special interest groups. Although he identifies internal stakeholders as key in any particular situation, he also treats external stakeholders as more important than internal ones. Stakeholder theory in organization study describes the corporation among different entities. Stakeholder theory in organization theories also comprises end-user who is one of the critical components of ICT development and implementation process (Mumford, 1979). Following Freeman's characterization of 'stakeholder,' Willcocks and Mason (1987) define the stakeholders of a computer system as “people who will be affected in a significant way by, or have material interests in the nature and running of the new computerized system”. Ahm and Skudlark (1997) incorporate the value of groups crucial to knowing the desirable features of an information system and the means to obtain those desired outcomes.

3.1.1 State as a stakeholder and its regulatory role in innovation and diffusion

As history and philosophy of science emphasize examining scientific instruments and social embeddedness, it is essential to look at the contribution of scientists, intellectuals, demonstrators, designers, interpreters who work together to institutionalize a new field of knowledge. Subuddhi (2002) defines 'science as a resource of functional too for society and as a package of culture are linked within the human organization'. One of the principal responsibilities of the Government is to direct the program of economic development to ameliorate the entire society, and organizational setup is some of the means to attain a political goal. Conflict of interest comes up between these groups. They represent different socio-economic and ethnic backgrounds. In this case, national objectives are prioritized over particular interests (Subuddhi, 2002). Government entities are clearly among the most potent institutional forces affecting innovation (King et al., 1994). The institutional power to influence and regulate can be linked to ideologies governing supply-push and demand-pull approaches to innovation. The prospects of implementation of ICTs in the departments are closely linked with the overall development of the state and the community. State intervention is essential mainly because of financial support.

Technology innovation and the progress of a particular society are closely connected. The state's role in developing technology starts with implementing policy to achieve desired public benefit. For this, the state is capable of spending resources on these developmental activities to achieve a particular goal. By keeping the societal benefits in vision, decisions regarding the choice of a particular technology by legislative and executive branches are implemented by government agencies or departments. The desired objectives are expected to be achieved through the integration of all stakeholders. Research and development alone do not facilitate deployment. The state's role is to determine the needs, design, and implement

policy to create a market mechanism that facilitates deployment. One of the respondents from the Department of IT, Government of Assam, informed that "Mobile tower guidelines are executed initially by the Central Government of India and followed by the state authority. Though the Telephone Regulatory Authority of India manages telecommunications-related issues (TRAI), and their guidelines are applicable all over India, the states modify and change them according to their needs. The mobile tower cannot be established near the hospital or residential area. The Cabinet mainly takes these decisions. If a technology violates the existing rules or norms of a society, it must be modified. After proposing a particular project, it goes to Additional Chief Secretary, the then Chief Secretary, Departmental Ministers, chief Minister and placed it in Cabinet. If approved in the Cabinet, it comes to the IT Department.

3.1.2 State: Facilitator of connecting the disconnected networks

Marxism influences Manuel Castells, but his work on Information society moves beyond Marxism and concentrates on interrelated social, economic, and political features to support an overall operation. Castells's work defines the interconnectedness of different features, although sometimes they are seen as contradictory. Castells' idea of the information age is related to a new society that emerged mainly from ICT-enabled development networks. He says that the information age has not removed the capitalist mode of production. Instead, it is an extension of capitalism. The prominent characteristic of the Information age is the spread of networks that connect people, institutions, and countries. This network society is not only a basis of global integration. It also brings about organizational change with *debureaucratization* of affairs, i.e., shifting powers. Centralized power and hierarchy exist as a formal arrangement in the spread of network, but the making and continuous making and remaking of the network deliver products and services in a specific setting. Jürgen Habermas developed the concept of a public sphere in capitalism, where information is the core of the

public sphere. Here actors could give their views that were available for ordinary people. This idea of the public sphere is an essential component of democracy, and in this way, information can be realized as means of functioning of a democratic society. According to the conventional view, knowledge about the social and economic relationship is shaped by academic research conducted by universities and other educational institutes. Nevertheless, in practice, all the information about family, school, work, leisure originates in government agencies as Government is the only entity capable of gathering and processing information (Webster, 2006).

Information management ...is fundamental to the administrative coherence of modern Government. The reliance on communications and information has become paramount of governments in their attempts to manipulate public opinion and maintain social control (Thunder, 1993).

Sarukkai (2008) has talked about the cultural aspect of ICT in the Indian context. A machine is expected to perform a function that it is designed for. Unlike other technology, ICT establishes a more open-ended relationship between the user and the machine. As the degree of the interface between the user and the machine is much higher; therefore, it is believed that ICTs are very people-friendly and can be applied as a tool in governance and social development. NIC was the first organization that brought to this state the use of satellite antennas – V-set. It sustained only for 7-8 years. Satellite antenna used to be a huge size. From the early '90s, the size of the satellite has become small. The use of V-set was introduced in the country by NIC. At that time, BSNL was not established. It was decided to make all NIC district centers be connected V-set. The most difficult thing was networking. The problem with V-sets was that they did not have high bandwidth network speed. When the pace of development was increased, the popularity of IT increased along with the increase in

demand for network bandwidth, and then NIC phased out the use of V-sets. With a high-speed-based line, they linked up all the centers. Based lines are cable. Some remote districts now also have V-sets baselines. To make ICT more inclusive, the state government of Assam has established public facilitation centers in DC, SDO (civil), and circle offices. Six schedule districts also have their public facilitation centers. Mandals are provided computers into 3:1 ratio. Approving authorities got laptops, and others got desktops. The main concept here is to work from home through a web-based application. The digital signature is one of the uses of ICTs in these centers that have been implemented. The officials signed on the paper digitally by using a dongle. Digital signatures have been issued for all the officials. The front end and back end are different. Back-end has an e-district application. These applications can be found in e-district.Assam.govt.in. Officials of a particular department got all the applications by logging into the website. Then they approve the application. A certificate can also be reissued using the certificate number with this website. It can be verified digitally again. At first, there were 27 district projects; now, it has increased to 33 districts. Only west KarbiAnglong is lagging due to a lack of infrastructure. Those working with public facilitation centers are permanent employees of the DC office. AMTRON appoints e- District project manager. District technical staff – Medhasu is appointed to look after the day-to-day activities. AMTRON has a call center of its own. A maintenance team also is appointed to handle the obstacles related to ICT. The call center was established to make AMTRON updated all the time. To include all the people from different sections or be aware of them, it is necessary to stress upon publicity, and the publicity process depends upon the government publicity fund. It is the Government that decides how to spend or allocate funds. They distribute on civil work human resources. Competent authority's approval is found much more important here. Some govern schemes like CSC- ROO and LukkorNaat are used to influence the public. At first, the central Government provided 80% of the total fund, and the

state government managed another 20%. Currently, states of North-East India are given more importance, and the current ratio is 90:10. The total number of government projects is 66 (introduced by the Central Government). Now it is 22 under some umbrella projects. Other states are receiving 60 % of the central Government's total funds. e- Government project software making is finished. It has been launched already; now, it is under operation maintenance. Infrastructure development training is going on for the proper functioning of ICT services. The Assam state government has been using this since 2011- 12. The system designated agency of the project is AMTRON. The project owner is the Department of Information Technology, Government of Assam. AMTRON executes the projects. For the execution of the projects, National Project Monitoring Unit (NPMU) and State Project Monitoring Unit (SPMU) have been appointed by the central Government. To monitor the projects of Assam, the Central Government gave responsibilities to Extensor (company). This company guided the state government of Assam. SPMU, WIPRO – they guided the implementation and execution of the projects. According to the Central Government's guidelines, the private sectors were also included. Different states have their SPMU. The Government tried to follow the growth pattern and working style of the private sectors as the private sectors are more competitive and have a smart way of working. Big process, System Integrators (SI) were selected. MEDHASU was the system integrator. MEDHASU executed the e-District project in Assam for five years. Now also, they are in the operation maintenance stage.

Common Service Centre (CSC) - 1.0 project completed on 31st March 2016. CSC- 2.0 project has been executed by CSC SPV (organization of Central Government of India). SPU means a particular purpose vehicle. Initially, it was aimed to establish at least one Common Service Centre among six villages. The main aim of the common service center was to deliver

Government to citizen services so that people could enjoy government services without visiting circle offices or DC offices. According to the state's need especially, it is decided which technology should be approved first. While talking about the needs, we can take the example of Guwahati Municipal Corporation (GMC). Earlier Municipality Corporation handled all the related public services manually. Then they introduced IT so that people would not have to face any hurdle in their day-to-day work, such as permissions for building houses and property tax. Importance was given to the actual needs of the stakeholders. When trying to introduce a new thing, there is always a fear of what to do, what not to do, and confusion regarding could be done or not. Therefore training is necessary. Departmental activities are based mainly on machines. The use of files is significantly less. If the Department conducts interviews to recruit new employees, people can upload soft copies of documents to their online portal. To avoid controversy, they have tried to make everything automatic transparent. On behalf of the Government of Assam, AMTRON provides computers to the HSLC passes students (1st division holders only). Earlier, students had to apply physically by applying to the head of the respective schools, and then it came to AMTRON. Then the process experienced change with the coming of the computerized system. It took less time to know who was interested in taking a computer and interested in taking cash. The cash is directly credited to the bank account of the students. Earlier passport applications had to be submitted to the passport office.

Nevertheless, when the passport department replaced this system with the online system, there were no other options left for people. Anyhow people have to learn the online system to apply for a passport. If a person can do it by him/herself, then s/he will not seek help from others. Again if a person cannot do it on his/her own, definitely s/he has to depend upon others. This is how things come up.

The Department also experienced different obstacles while making IT a part of the daily activities. If there is any genuine problem, they try to modify or regenerate the existing technological system through the business reorganization policy. If they see that they can simplify things based on the input they receive from the stakeholders or if it is observed that things can be simplified by eliminating specific steps, then these changes are welcome by the Department. Records are kept both in hardware and software mood. If something has to be delivered or posted, it is sent by mail. Computer operators have replaced typewriters.

3.2 Nature and Design of Post-Industrial Organization

According to Weber, particular organizational forms emerge during specific periods in history and under specific social and technological conditions. As the dominant formal corporate form and the basis for organization theory assumptions in the late twentieth century, bureaucracy developed in response to post-industrial rationality, the weakening of primary institutions such as family and church, and the technological advances of the industrial revolution. Railroads, telegraphs, and telephones played a prominent role in developing the transportation and communication industries to accomplish their goals. The ability to manage across broad geographic areas and differentiation, integration, and coordination were crucial in these industries. These industries enabled businesses in other fields, such as manufacturing and retail, to operate globally. Thus the technologies of the 19th century facilitated the emergence of the bureaucratic organization with its focus on standardization and mass production. This is what Weber meant when he said that organizations do not exist in a static form. As technologies and social conditions change, so does the nature of the organization. The bureaucracy is ideal for mass production, markets, relatively stable environments, and purely economic goals. Standards, homogeneity, and hierarchy are the main characteristics of bureaucracy. Bureaucracy is no longer the

appropriate organizational form with time and changes in economic structure, and new organizational conditions can be expected within the crucial question of what kind of organization might be possible in the emerging post-industrial age. Several prominent figures who are associated with post-bureaucratic organizational forms include Galbraith (1967), Marcuse (1967), Bell (1973), Huber (1984), and Reich (1991).

There are two kinds of organizational system—the mechanistic and organic (Burns and Stalker, 1961). The organic model is more suited for change and thus more conducive to innovation (Aiken and Hage, 1971). The 21st-century organizational forms tend to arise in response to social and technological advances (Victor and Stephens, 1994). Post-Industrial society experiences a radically different environment for organizations seen as different from industrial society, and people are shifting from institutional help to more self-reliance in all aspects of their lives (Huber, 1984; Naisbitt, 1982). According to Quinn and Rohrbaugh (1983), an organization's effectiveness can be measured by four simultaneous goals: economic efficiency, internal coordination, adaptivity, responsiveness to the external environment, and the use of human capital.

In contrast to bureaucratic organizations, Post-Industrial ones emphasize demassification, hyper-flexibility, continuous improvement, and innovation. These organizations are expected to be stakeholder-focused and globally oriented. The post-Industrial organizations also try to blur the external boundaries (Huber and Glick, 1993). Post-Industrial-organizational environment demands faster and more frequent organizational decisions to create innovations for external consumption. Organizations require information to decide when decisions and innovations are needed, and decision-makers require information to conclude. Organizations are expected to be more continuous in adopting innovation.

3.3 Organizational Innovation and Innovation Diffusion: Theoretical Framework

There are micro-level (individual), middle range (organizational) and wide range (society) theories and research design in ICT and society research (Rice, 2005). As previous researches have explored that Information system research in organization is not rooted in a single theoretical perspective while studying the relationship between information technology, people and organizations. These theoretical perspectives are used to investigate the diverse arena of information technology. According to Positivist Research philosophy organizations are understood to have a structure and reality beyond the actions of their members. Positivistic research techniques encourage deterministic explanation of phenomena. The Interpretive philosophy of Information System research considers that social relations, division of labor are not given. Rather, the social world in an organization is produced, shaped and supported by human through their action and interaction. The fundamental principle of interpretative research is that reality is socially constructed and individuals act towards things on the basis of the meanings that things have for them, that meanings arise out of social interaction and that meanings are developed and modified through an interpretive process (Boland, 1979).

But the main criticism of interpretive perspective is that it is not able to examine the external conditions that also give certain meanings and experiences. The critical research approach argues that organization cannot be studied in isolation of the industry, society and nation within which they operate and the essential effect of economic, historical, social and political conditions on the nature and development of phenomena.

Conceptually innovation is an idea, practice, or material artefact perceived as new by the relevant unit of adoption (Zaltmna et al., 1973). The conventional meaning of innovation considers innovation a single event phenomenon (Wolf, 1994), but refuting this idea,

Damanpour and Schneider (2006) considered innovation a multi-event process that includes three well-established stages: initiation, adoption, and implementation. A significant component of the economic literature on technological innovation is product innovation, but sociological literature emphasizes social structure rather than product innovation. Social scientists use innovation to refer to new organizational forms, processes, and routines. A sociological perspective on innovation concentrates on the influence of social structures on both the product and innovation process within organizations. Research in the organizational literature suggests that innovation success is closely associated with organizational factors that are likely to influence the success of particular technological innovations. Research in the organizational literature suggests that innovation success is closely associated with organizational factors that are likely to influence the success of particular technological innovations (Hill 2010).

Innovation in an organization incorporates the generation, development, and implementation of new ideas and behavior to make the organization's performance more effective (Damanpour, 1991). Innovation adoption and its diffusion in an organization are seen as dynamic and time attributed processes involving transferring information, knowledge, and innovation spread through large-scale and heterogeneous societies (Lechman, 2015).

The diffusion of information and communication technologies in developing countries needs regular use and specific organizational features to support this process. Information system in developing countries introduces the transfer of technologies and organizational practice. Information system research is contextual as it addresses technology implementation issues and uses inside and outside the organization rather than in a laboratory setting. Therefore, Information system research considers a changing entity within its environment (Avegerou, 2001).

A closer relationship between technology and its social context was first suggested by the socio-technical researchers in the 1980's who put forward the concept of Information systems as social systems accompanied by changes in organizational form and function.

Hartley (2005) stated that innovations in governance and services are more ambiguous because innovation in a government organization is not only about a physical artifact but a change in the relationship between service providers and their users. Therefore, while making any judgment about shaping innovation in governance, it should focus on processes, impacts, outcomes, and products. In the contemporary period, innovation in government departments has introduced new political arrangements in local Government and changes in the organizational form and arrangements for the planning and delivery of services (for example, the combined effort of public and private sectors to provide services). During the study, it was observed that there are two types of innovation in the departments-

- a) Service Innovation –new ways in which services are provided to users
- b) Process Innovation- new ways in which organizational processes are designed.

According to Benington and Hartley (2001), the context of traditional public administration was stable, and professionals primarily straightforwardly defined it. In the traditional public administration, the population was treated as a homogeneous category, and the strategy to administer them was mainly state and producer-centered. In contrast to traditional public administration, the in-network governance population is treated as diverse individuals, and their problems are more complex and volatile. Therefore, innovation is seen shaped by civil society as more emphasis is given to public value.

The term '*diffusion*' derives from '*diffusion*', which means spread, expansion, dissemination, propagation, or generalization. From a socio-economic point of view, diffusion of innovation

means the gradual spread of new technologies and new ideas expected to bring intense changes towards the economy and society (Lechman, 2015). "Diffusion is the process in which an innovation is communicated through certain channels over time among the members of a social system. It is a special type of communication in that the messages are concerned with new ideas. Communication is a process in which participants create and share information to reach a mutual understanding." (Rogers, 2003)

Diffusion of innovation is a learning process based on social communication networks, and these networks are hierarchical. Diffusion of innovation among individuals occurs through a local network (Brown, 1969). A knowledge-based approach to innovation in organizations redefined innovation and diffusion as the construction and distribution of knowledge, and this process is influenced by other organizations, i.e., inter-organizational communication, collaboration, 'network' between friends, colleagues, etc. According to Rogers (2003), characteristics of a particular innovation such as relative advantage, compatibility, complexity, trialability, and observability are also responsible for its diffusion. Among the characteristics of organizations, organizational size and closely related structural variables; other structural features of organizations, personal characteristics of leaders and the workforce, and characteristics of the communication environment determine the assimilation process (Fichman, 1999).

Government intervention is a crucial element for developing nations to accelerate innovation. King et al. (1994) study institutional intervention in IT innovation, emphasizing the regulatory power of institutions and ideologies of supply-push and demand-pull models of innovation.

Laudan (1985) mentions Information Technology as an ongoing process of innovation. Institutions, a class of social and economic entities, influence and regulate the diffusion of

innovation. Early institutionalism in sociology observes how the rules and regulations shape individuals' actions, while contemporary institutionalism argues that the social context is shaped by social action and vice versa. Individual actions in particular institutional circumstances influence how to adopt a particular technology (ibid). The importance of the combination of cultural, institutional, and situational aspects of organizations has increased in the recent field of organization studies. Barad (2003) discusses how language, discourse, and culture matter in theorizing material artifacts, bodies, arrangements, and infrastructure through which practices are performed.

Once the technology is accepted, it starts to act upon the institutional structure of an organization either by sustaining it or changing it. Various themes that came out of the field visit are summarized below-

3.4 Identifying the problem and creating a solution: First step of the innovation process

Saith and Vijayabaskar (2008) describe technology (from an optimistic point of view) as a problem-solving mechanism that helps overcome the limitations of resources. It is used to generate growth and is also a tool for delivering development. Following this technology idea, the departments have adopted ICT as a medium to possess the 'hypothetical' benefit. The instrumentalist view of technology treats ICT as new magic that could activate efficient governance.

After the Economic Reform Policy of 1991, the main aim of India was to reduce poverty and build social infrastructure through proper economic management. It is recognized as crucial to the regeneration of the Government.

The development of IT is thought to be fruitful in policy formulation, promoting participation, improving security quality, making planning more productive, and empowering

citizens. India accepted DISNIC, a National informatics center program to provide IT facilities in 440 districts. In some districts, the land record system introduced the computerization facility.

Information and communication technologies are thought to reduce rural poverty, inequality, and environmental degradation. The application of information and communication technology can be categorized as-

- a) Decision support to public administration.
- b) Improving services to citizens.
- c) Empowering citizens to access information and knowledge.

Each category requires different technologies and has different critical success factors in achieving the goal.

The first category emphasizes upgrading planning and observing development schemes.

The second category tries to deliver government services to citizens. It will bring changes in the relationship between citizens and the Government and make the government activities more transparent. The introduction of Information and Communication Technologies can make it possible for rural producers to know up-to-date knowledge about the market condition of the goods and services. Through ICT, the rural people will be helped to access knowledge about improving productivity in their work, health practices, and learning about their environment. ICTs will empower rural people by developing the skills necessary to generate rural employment opportunities.

Rogers (2003) has identified recognition of a problem or needs as the first element of the innovation-development process, encouraging research and development agencies to design

or create innovation to solve the problem or need (Rogers, 2003). According to Usher (cited in Robertson, 1967), 'for an innovation to occur, a problem must exist.' The Millennium Development Goals (United Nations 2009) has the target to remove poverty and hunger. Improving health facilities and education for the poor people can remove the problems. ICTs are thought to be a way through which people may get proper computerized health information systems. Other ICT-based initiatives such as Telecentres have the high potential to bridge the digital divide for the poor (Reelley and Gomez). Nevertheless, in the words of Warschauer (2003), bridging the digital divide is not only about technology but also about the social, political, and institutional factors that affect people's adoption and use of technology.

While conducting in-depth interviews in different government departments of Assam, one of the senior personalities said that ICT serves as a democratic enhancer within the departments as it has been working to improve accountability. To make government services more transparent, accountable, and efficient, the departments where the study was conducted have been introduced ICT services between Governments (G2G), between Government and Citizens (G2C), between Government and businesses (G2B).

The opportunity to use ICT exists in every Department because the need exists. According to the state's needs and other stakeholders, which application should be approved first. Awareness of need is the first element while adopting ICT innovation in a department. ICTs innovation is seen as better than the idea, program, or product it replaces.

According to one of the respondents, corruption may deteriorate the quality of government performance and may be an obstacle to the proper use of public money in terms of essential goods services. That causes more poverty in the state. So, with poverty reduction and human development, ICTs have been introduced to address citizens' expectations. ICT facilitates electronic means of processing transmission and display of information along with faster and

cheaper communication. The aim is also to boost efficiency and productivity, reduce transformation costs, and remove all barriers from everyday people to reach out Government.

Of late, the pace at which technology is transforming, there is hardly any field left without being swept away in the tidal wave created by it, and men cannot help dealing with it. The internal affairs of the departments are also not an exception in this regard. It is well-known that the sheer futility of disclosure can no longer make an impact on everyday people. What is more irksome is that, not long ago, the practice of frequent visits to the higher authority of concerned political party (i.e. to Delhi) to take even a small decision by the politicians did incur much expenditure causing mere wastage of public money. It is noteworthy that this culture has not terminated, but with the advent of video conferencing, remote working has become pretty much effective. Even impromptu meetings can be organized and held all at once. Recognition of a problem or need by an organization leads to the search for a solution. ICT has also replaced the traditional file management system that took much time while keeping a record. To address the issue of 'corruption' that exists in different forms and make everything transparent, the departments have implemented an online file management system under the umbrella project 'e- Office.' The departments where the study is being conducted have introduced two types of ICTs innovation- Intra-organizational innovation and inter-organizational. The implementation of e-office comes under intra-organizational innovation, and on the other hand, the use of inter-organizational innovation supports transparency used in the community development program. While conducting in-depth personal interviews in NIC, one of the senior officials believed that ICT is serving as a 'democratic enhancer' within the departments. ICT has been used in the departments to replace the 'old bureaucratic' system, which is more or less static and unable to adapt to changing circumstances. ICT has been introduced in the activities of the departments to reduce unit cost, changes from vertical

hierarchical command to horizontal relationships. One of the main reasons to include ICT as a part of the departmental activity is to make the public officials more accountable. Decentralization advocates the transfer of decision-making to lower levels of the public sector and the creation of more autonomous units within and beyond the Government to stimulate initiative, increase local responsiveness and provide a tailored local solution.

The Department of Agriculture, Government of Assam, has introduced an e-Governance plan under the National e-Governance Programme (NeGP) to connect the citizens in their locality to deliver governmental services at affordable costs covering information related to pesticides, fertilizers, and seeds, soil health. In Assam, traditional farming methods are followed, which involves high risk and uncertainties. Due to the unavailability of accurate weather reports, seeds are very often destroyed by heavy rainfall and unfavorable weather. Market prices and demands are so fluctuating that the farmers are not getting reasonable prices. So, the Department has introduced some apps such as KishanSuvidha, PusaKrishi, Crop Insurance Portal, Agri Market, and NeGP projects to benefit farmers and the rural economy affordably connect rural people to global information networks.

E- Panchayat, a Mission Mode Project, was implemented by the Department of Panchayat and Rural Development, Government of Assam 2015 in rural employment generation program, poverty alleviation program, and the Pradhan Mantri Awas Yojana Gramin (PMAY-G). Functions such as allotment of money, monitoring the schemes, making bills, vouchers related to the earlier schemes are done through the e- Panchayat project. The project has been introduced to replace the manual or traditional resource allocation method for beneficiaries of a particular area. Till now, PRIASoft, National Panchayat Portal (NPP), Local Government Directory (LGD), Plan Plus, Action Soft, Area profiles, National Asset Directory (NAD) have been introduced to strengthen e-Governance in Panchayati Raj Institutions (PRIs) in the

state and build associated capacities of the PRIs for effective adoption of the e-Governance initiatives. These systems maintain beneficiary data, photographs of beneficiaries and schemes, vouchers, financial data. These information systems also include data of transfer of funds directly into accounts of beneficiaries using Digital Signature.

The Information system introduced in the health sector by the National Health Mission on behalf of the Department of Health and Family Welfare, Government of Assam includes two categories- Clinical system and Administrative system. ICTs in the health sector have been introduced to bridge distances and provide access to clinical knowledge, specialized expertise, and health services to save lives and costs. ICTs have been adopted as an alternative tool to answer the questions of access, quality awareness, and operational efficiency in the health care sector. The clinical system has been used to deliver statewide Integrated Electronic Health records, Community and Primary care, Clinical support, Telemedicine. In contrast, ICTs in the administrative system of the Health Department look after HR management, Finance, Health Facility Assess Management, Hospital Management System, Insurance Management system, report generation. NHM, formerly known as NRHM, is under the Department of Health and Family Welfare. Employees are recruited through an online recruiter cell. If it is talked about the IT initiative by the Department of Health and Family Welfare, the Government of Assam have given some new software through Government IT system to the Department- Health Management Information Systems (HMIS), Mother and Child Tracking System (MCTS), National Identification Number for Health Facilities (NIHF). The Department has also introduced some systems at the local level, such as the Health Service Monitoring System. Other data are uploaded on the Government portal. The State Government does not have its projects on IT. The state government implements the systems suggested by the Central Government.

3.5 Structural rearrangement in creating change

Langdon winner's argument on the political nature of technology is essential both for creators and consumers of new technology. ICTs introduced into an organizational environment can embody specific arrangements and continuously reinforce those arrangements through the possibilities.

Implementing innovation in an organization setup is also about creating change by improving something or introducing something new. To attain a particular goal of an organization requires internal innovation to some extent. These internal changes have to occur to experience the external outcome. These changes may be planned or unplanned, enhancing the quality of services or distressing (Gobble, 2013). It is believed that organizations with old technology can have increasing problems surviving in the market. ICTs are interpreted as creative destruction as it has helped the organizations change some elements of the organizational culture by taking specific actions (Verspagen, 2004). In the literature of innovation management, four perspectives are found. The institutional perspective looks at how socio-economic condition help in shaping new ideas and practices; the fashion perspective look at how dynamic relationship is established between users and innovation providers; the cultural perspective see how organizations react to new practices and the analytical perspective studies the impact of innovation on organization's effectiveness (Birkinshaw et al.2008). One of the respondents from the Department of Information Technology Government of Assam mentions that the availability of technology does not mean that all are affected by it equally. The role of technology is thought to be only 15%, Business Process Reengineering is the second component that comprises 35%, Change management is the biggest problem that includes 45%, and the rest of 5% is luck that includes leadership qualities of a leader in a department. Only developing particular software

cannot make a project successful. Inside the Department, it is necessary to have a champion who can initiate the new idea. After the initiation stage, 45% effort is given to change management. The respondent informed us that change management does not mean here to move people from the existing post. Changes come with the capacity building that suggests developing and strengthening the skills, instincts, abilities, processes, and resources that organizations and communities need to survive, adapt, and thrive in the fast-changing world. To make it a part of the necessary activities of the departments and to deal with the questions regarding ICT intervention, use of the information, the delivery of transparent and accountable information, some steps have been taken up at the state level and accepted by the departments.

3.5.1 Formation of new committees:

Some committees have been formed to make ICT use in the departments more effective and sustainable. These committees are set innovation priorities, change the culture, allocate resources, make decisions and monitor the projects.

The operation committee headed by the Department's Additional Secretary is responsible for designing and monitoring the projects. Once the particular design of ICT innovation is found appropriate to address the particular objective of the Department, then it is approved by the state apex committee headed by the Chief Secretary, Government of Assam. The empowered state committee is formed to monitor the ICT projects of each Department, and the responsibility of execution of each project is assigned to the implementation team of each Department. The Department of Information and Communication Technology, Government of Assam, has also introduced a new project named e- Prastuti – standardization of websites that presents an integrated and unified web experience for the citizens across all government websites and efficient information and services delivering to the citizens. To introduce this

delivery of information system, as a first step, an 'empowered structure' has been created under the guidance of the State Chief Secretary, who has been given the role of Chief Responsibility Officer (CRO) of the project. A website Development cell (WDC) has been formed supported by National Informatics Centre to assist and guide departments in designing and developing their websites. The Government of Assam also constituted an expert committee that includes members from the Indian Institute of Technology Guwahati to guide on the design of the websites.

3.5.2 Interaction with research organizations

Though the team concept has primarily been applied to manufacturing, the emergence of ICT in the esteemed departments has changed the way of the working culture. What was done individually is now done by a group of workers. ICT in the organization brings new possibilities for the creation, modification, transmission, and storage of information. The introduction of ICT into an established organizational context required individuals to learn not only to cope with the material features of the innovation but also to deal with the new ways in which that artifact handled the information. Information is closely linked to an organization's social structure. An organization's social structure is accompanied by communication and interaction among members (Leonardi, 2007).

The National Informatics Centre at the central level and AMTRON at the state level are the research organizations that perform some crucial functions while introducing ICTs based projects in the government departments. National Informatics Centre has been selected as an agency to develop the solution design and system Requirement specifications, solution development, solution testing, acceptance, solution implementation, training, and change management. One of the pioneers of NIC was interviewed for the study, and he said that when he joined NIC, there was not a single center of NIC in North-East India. He was

basically from Assam. Therefore he was sent from Delhi to Assam by the General Director of NIC. He started the center with a peon. Right from 1986, they have started functioning at Guwahati. Then they started building state centers of NIC in North- East. In every district, NIC has one center throughout India. NIC plays a significant role in setting up its district centers in 27 districts no matter what type of district it is (developed/ developing/ underdeveloped/ remote). District centers are. In each district, NIC has two persons, and they are central government employees holding B.Tech/ MCA degree. All the centers of NIC are connected with a high-speed computer network. So all the computer-based functions of the Government (local/ network-based/ web-based) system, e-mail, video-conferencing –all are possible with the help of NIC.

On the other hand, AMTRON is an organization of the Assam Government (PSU). This Department provides IT support to the Government. When we talk about Government, it is central Government, state government, district administration, sub-district organizations. NIC has no office at the sub-district level such as revenue, circle level, development block level, or the Gaon Panchayat level. NIC provides support to those levels of administration. NIC supports all the layers of Government with an IT-based system. When NIC was established in all the states during 1986-87, NIC worked differently. Being a central government organization, NIC always works with state government premises. They work from state government buildings and work closely with the state government. NIC develops the software, and communication with familiar people is established with the help of AMTRON. AMTRON does not provide any direct services to the state. Suppose a person wants to get a PRC. Though this is a function of Home Ministry, people apply through an e-District online portal. AMTRON is the only service enabler or facilitator of 46 different online services available currently.

3.5.3 Changes in Employment Structure

We introduce ourselves to the radical economic change in the Information society. The mode of production has been changed from agriculture to industry and then industry to service sector. There is a replacement of production workers by the information workers. The emergence of information technology is restructuring the economy and society. There is an increase in demand for information holding activities, and this advanced economy is more complex because this economy requires more managers, accountants, researchers, bankers, advertisers, and administrators. Marx argued that changing technology is a critical element in shifting relations of power.

Nevertheless, information workers pay much attention to technology in this service sector, not enough to power. It is thought that a new class would emerge due to the spread of information technology. Education and skill levels are becoming more important criteria for determining social positions. The newly developed society, where everything is informalized, has shown a waste of labor, skill, cunning. As machines have become masters over our lives, the beauty of our life has been injured.

The first shift from the industrial society to the information society brought some changes in terms of work, but the nature of the change may be harder to recognize. With the emergence of the information society, the general skill level is rising. However, at the same time, others see only the job losses entailed in automation or the skill losses from the jobs that remain. While talking about the information society, there is little difference between labor and management. It is characterized by an egalitarian style of work where the decision is taken based on discussion between boss and associates. Status symbols and hierarchies are rare in such a working environment (Lyon, 1991).

Changes are observed in the employment structure. When ICTs were introduced in the government departments, those proficient with the traditional working method could not deal with it. Therefore, People were hired from private enterprises on a contractual basis, such as EPITOME- Computer Training School, NIIT Guwahati. To work with NIC also, it was necessary to hold B. Tech / BE degree, especially in Computer Science. Again, it was observed during the study that a new post has been created within the departments called 'computer operator' who look after the IT-related functions of the concerned Department.

Interestingly these computer operators acted as 'type writers' of the Department. While asking why keeping this post in the Department, we were told that "some issues are involved while adopting a new idea such as fear, anxiety, lack of interest. Age group is an essential factor here. People of a particular age group are not interested in adopting a new idea. Sometimes those who have been working with a traditional method for a long time are thinking about what to do to learn new things as they are not going to use this anymore, and there is no need to take some extra burden before retirement. This category of people who have exempted themselves from taking risks in using a new idea seek help from computer operators to perform their ICT-related activity.

A new post has been created outside the Department's named Village Level entrepreneur appointed by the Government. These VLEs work in the Common Service Centre (CSC), established to bridge the citizens and the Government. Shared Service Centers have the aim to provide government services to citizens. The CSCs are run by a person of a particular village who does have the computer knowledge to some extent. Government and Government do not appoint the person, and he is seen as self-sustained. When asked about selecting a person from a particular village rather than appointing a government employee, the respondent said that as the VLE is the key to the CSC operations' success, the VLE should be carefully chosen. If a government employee is selected who is an outsider to the village may

not be able to identify the local needs of that particular area. If a person is selected from his/her area, there would be a strong social commitment and respect within the community. Another reason for selecting VLE from his/ her village is that a government employee is a salaried person; therefore, the Government has to pay him/ her even if he fails to provide the necessary services to the villagers.

Therefore, the CSC scheme was designed so that the revenue generation of the VLE is directly related to the services that he/ she provides to the community. Apart from providing Government services to citizens, the VLE also provides Business Citizen Services. The VLE provides infrastructures from the Government and the computer the VLE manages to run the business.

3.5.4 Public-Private Partnership

As a part of the SMART governance, the ICT telecentre projects are implemented through Public-Private Partnership (PPPs). The proponents of PPPs believe that without the Government's unnecessary interference, the private sector will connect the citizens more effectively. Even while IT policy was formulated, the CEOs from CISCO, MICROSOFT were also consulted. Their views and suggestions were taken into account. For the execution of the projects, National Project Monitoring Unit (NPMU) and State Project Monitoring Unit (SPMU) have been appointed by the central Government. SPMU, WIPRO- they guided the implementation and execution of the projects. The Government tried to follow the growth pattern and working style of the private sectors as the private sectors are more competitive and have an intelligent way of working.

3.5 .5 Training Facility for the employees

Providing training facilities both from NIC and Assam Administrative College among the employees of different government departments is considered external support necessary for

the effective use of ICTs within the departments. The availability of Information and Communication technology did not automatically make the users learn about it. Therefore, end-users in each Department were trained to make the most effective and productive use of networked and electronic information services. NIC and Administrative staff college designed training programs to provide end-users with the necessary skills to search electronically. The training program also included workshops.

3.5.6 Establishment of Information Technology Department, Government of Assam

The IT Department, Government of Assam, was established in 2008 to provide the infrastructure for automation. There are some differences between the Department of IT, Government of Assam, and other departments of Government of Assam. It implements the governance for the use of network and operating systems, and it assists the operational units by providing them with the functionality they need. The Information Technology Department, Government of Assam, deliver state e-services like e- District, Assam Police Service-Crime and Criminal Tracking (CCTNS), NRC (State Coordinator of National Registration, Downloadable e- forms with supportive documents and e- pass application. The Department of IT, Government of Assam, is an administrative department. They generally instruct AMTRON to implement a new policy, and accordingly, AMTRON executes the policy at the field levels.

3.5.7 Localizing innovation: a step to reinforce diffusion of ICTs

The state government departments generally work with central government projects. During the interview, the district in charge of the IT department informed us that the projects have to be modified at the local level depending upon the infrastructure facility availability of skilled professionals. When the present director of NIC was interviewed, he said that the application of ICTs started in the entire North-East in 1986. At that time, he was working in

another part of India. The General Director of NIC selected him to establish this center in Guwahati. To initiate a new thing, the role of leadership is essential (Rogers, 2003). As he had adequate knowledge about the state, he was selected for the foundation of NIC in Assam

Among the various services of ICTs, NIC has introduced e- Prastuti, and they have standardized all the departments. This standardization has been done at the state level, but it may take some time to introduce at the district level. Under e- Prastuti, AMTRON has designed Assam.govt.in. Before that, different departments under the Government of Assam had their third party. It caused some inconveniences while searching for any information from the concerned Department. Then the state government, along with AMTRON and NIC, redesigned all the processes and standardized them. It took almost two years to accomplish the whole system. The intra-network system is different from the system provided by BSNL. A controversy regarding the Assamese- Bengali language took place recently. It was appealed to include the Assamese language in the universal google system. The Bengali language existed from the beginning. Therefore, instead of introducing a new language that could cost more, the state instructed AMTRON to keep both the systems with an equivalent bit to read appropriately. For the functioning of the State activities, two types of network arrangement exist in Secretariat- SWAN net, which can be affected by outside forces. Another arrangement, i.e., NIC net can be penetrated from outside. Therefore, it was decided to use only the SWAN net inside the secretariat in place of the NIC net. A year ago, some records under govt. It got damaged due to some technical reasons. Again state decided to keep two types of networks for its functioning –govt, in and nic. in.

3.6 Institutionalization of ICTs through social interaction

Innovation has also been conceptualized as the whole process of developing and implementing a new idea. According to Holt (1971), innovation is concerned which change,

and there can be a distinction between technological innovation and social innovation. Technological innovation, according to him, is the application of new technology, whereas social innovation is connected to the application of new social patterns of human interaction. Mumford (2002) defines social innovation in an organization as a new form of social and interpersonal interaction established to achieve the organization's common goal. Social innovations are expected to produce immaterial outcomes based on social interaction related to shared norms of that particular context (Perry, 2000). According to the Social Construction of Technology (SCOT) approach, the immaterial meaning is often seen as the process of innovation that is non-linear and establishes interactive relations that include science, technology, policy, demand, learning, and production. The innovation process within an organization includes learning and the accumulation of knowledge. The study shows that ICT innovation occurs by recombining the existing elements of a particular department. Recombination of new ideas has developed a new synthesis depending upon the selection mechanism necessary to select and reject a particular service. Generally, government departments are social units and have specific purposes. Each individual in the organization takes individual desire to reach the collective. European Commission defines social innovation 'in terms of both ends (a new solution to social problems) and means the new form of social organization needed to ensure their delivery (EC, 2010). Social innovation aims to obtain economic growth and develop connectedness and solidarity among groups by renewing the public sector, which cannot be achieved solely by focusing on technical innovation. While studying the innovation diffusion process in the esteemed Department, it was essential to focus on instrumental and non-instrumental factors of social innovation adoption. As a social innovation ICT adoption in the Government, departments are seen as promising sources that pay attention to social, economic, and environmental needs. The use of ICTs innovation is no longer a technological matter involving the development of

technical solutions in a government department but as a process involving social interactions. The ICTs innovation and subsequent diffusion are not merely understood by the combinations of tangible forms of capital (physical/financial) but also by intangible forms such as social capital. The diffusion of ICT innovation depends upon the individual's interest, but in an organization, it is seen developed through personal interaction, and this interaction process is necessary while motivating the fellow members of a department to adopt a technology.

This study observed that incorporating ICTs as a part of the departments' daily activities has created some new form of interaction among different actors. This interaction is seen among innovators, implementers, policymakers, and end-users.

The diffusion of ICTs starts with the process of technology transfer that includes three different stages, and each stage comprises different sorts of interaction-

- a) Transfer of Information on the stakeholder's need for new technology to the research system.
- b) Transfer of results to development agencies/ government departments.
- c) Transfer of results to the stakeholders.

AMTRON and NIC, two foremost research organizations in Assam, perform the responsibility for conducting research relevant to the communities' technological requirements. The extension agencies perform the crucial function of collecting information on stakeholders' technological requirements, which generate the research and then prepare a package of inputs consisting of research results and supports physical and financing input. Finally, the Department offers the package to the stakeholders and the community to promote inclusive development. The stakeholders may then accept or reject this package depending

upon the characteristics of the innovation and the ability of the innovation to address their needs. Interaction between these groups shapes the flow of physical resources and funds and the flow of communication. In the case of agriculture, the introduction of the Green Revolution in the 1960s was the starting point of introducing technology to relieve the food shortage, and this showed the transfer of the new technology from the research institute to the farm. Before coming of ICT in agriculture, different technologies were provided by Assam Agricultural University, Jorhat. The respondent let us know that at that time, the Department of agriculture was like a field of the experiment of technologies. Some of the respondents said they found difficulty dealing with the new technology at first. They tried to tackle it by seeking help from peers or family members. When it was asked about the nature of internal support that required to motivate the employees of the Department, one of the early adopters of ICT innovation revealed that "Had I had the hammer with me all the time, it would have been tempting for me to treat everything and everyone as if they were some nails, for men have been struggling to overcome the temptation of doing the cakewalk. When in reality, what I want is to make the things like the lives of crops, which are to be reaped in due time. Their growth depends upon how you nurture them". Interaction also takes place between industry and academia. AMTRON maintains its function in collaboration with Cotton State University, Gauhati University, and the Indian Institute of Technology Guwahati.

The study's departments rely on ICT innovation to improve service offerings to attain desired outcomes. Research has suggested that support from co-workers can be seen as an essential factor of constructive use of ICT in the Department's day-to-day activities. Close social interaction between co-workers develops support within the Department. The social process is based on frequent interaction and communication between fellow members (Grant and Berry, 2011). Through this interaction or network, coworkers acquire knowledge to achieve

the collective goal of the Department. While conducting the study, it was observed that there is a direct link between the age of a user and his/ her interest to adopt ICT to perform the departmental activity. Those who will retire from their job shortly are found not so interested in adopting a new idea, and they have been the late laggards in the innovation development process. Those who are early adopters in the departments assist the late laggards, and when these late laggards are supported and helped by early adopters of ICT innovation through social interaction, they become inspired or desire to learn the organization's service innovation.

3.7 Interaction with external sources of innovation

The design of a particular technology depends upon the need of the Department which is using it. The departments decide which software package is necessary for the scheme project. Then they hire the technical institute as the outside support. Mostly the departments hire National Informatics Centre. NIC is one of the prime stakeholders engaged in the design process. When NIC was very new in the states, there were many doubts regarding NIC, people used to see NIC as some kind of a CBI or RAW kind of organization, and NIC was trying to steal the state government data. Many debates were going on during the first phase of the establishment of NIC.

Therefore, an MoU with the state government was needed that could provide some kind of support. When a central government organization wants to work with the state government, it is necessary to provide them with space, security, power, etc. NIC can be said to be a partner agency of state government. NIC supports IT-related services to all the departments of Government. Government departments and PSU are their priority, while boards come after that. NIC provides services free of cost. They usually do not charge unless they have to hire some resources. In place of that, NIC has a high bandwidth network. If the Government wants to develop software through NIC, NIC provides software. NIC also provides training.

NIC has two persons in each district. Decisions are taken by NIC headquarters regarding technology adoption, change management, training. The organization's innovation development process results from interaction with external development partners. All the institutes of higher learning are linked up by *nkn* (National knowledge network). The network used for government function is called a *nic net* (Used by the Chief Minister, chief secretary, commissioner secretary, DCs, and blocks). NIC manages both *nic net* and *nkn*. Internally both the networks are the same, but their purposes are different. Skills personnel are employed to look after these issues.

NIC guides other organizations. The primary function of NIC is to inform other departments about the emergence of technology, the launching of new technology, the uses of technology, and how the new technology is better than the existing technology. When a Government organization needs new technology, they use it to consult NIC most of the time. If a new technology is not used in Guwahati or any parts of Assam but is already being used in other parts of India, it is encouraged to share. The user departments- The Department of Health and Family Welfare, Government of Assam; The Department of Panchayat and Rural Development, Government of Assam, The Department of Agriculture, Government of Assam are seen rely on external entities such as their directorate Department of Information Technology, Government of Assam, AMTRON, NIC for support and help. The user departments have continuous interaction with these external partners and implement their suggestions into their products and services to meet the organizational goals. These supports are needed to enhance the service portfolio.

3.8 Scope of Reinvention

Until about the mid-1970s, it was supposed that innovation was a consistent quality that was not changed as it diffused. Then, in the 1970s, diffusion scholars began to pay more attention

to the concept of reinvention, defined as the degree to which an innovation is changed or modified by a user in its adoption and implementation process. One of the respondents from NIC says, 'If we look at kind of technology we used thirty years back and technology we are using now has a huge difference. NIC was the organization that brought to this country the use of satellite antennas – V-set. This is not a new thing. It sustained only for 7-8 years. Satellite antenna used to be a huge size. From the early 90's the size of the satellite has become small. The use of V-set was introduced in the country by NIC. At that time BSNL was not established. It was decided to make all NIC district centers to be connected to V-set. The most difficult thing was networking. The problem with V-sets was that they didn't have high bandwidth, network speed. When the pace of development was increased, the popularity of IT increased along with an increase in demand for network bandwidth, and then NIC phased out the use of V-sets. With high speed based line they linked up all the centers'.

E- District project- it was introduced based on people's needs. So there was a need to visit different offices to know about people's choices. Some services are needed only once, but some are used long-term. All the services are not the same in all regions. Some services are more prevalent in cities than in rural areas—negotiations with citizens (directly / indirectly). There is a difference between the service provider and service users. Therefore it is essential to know whether the users are happy or not. Once people are introduced to a new thing, they start to talk about what service they need that. Psychological – Some people are not interested in adopting a new idea if there is no personal benefit.

In some areas, it was noticed that only one common service center is providing applications among different common service centers. Even 400/ 500 applications these centers have to provide in a single day. As people have to share/ her details, even the bank details, therefore adoption rate is not so satisfactory in rural areas. AMTRON looks after all the security

violation issues. AMTRON has introduced digital locker facilities where a person can upload his/her documents.

Modification or replacement of a technology that is not under the Department of IT's jurisdiction, Government of Assam. In this context cabinet's decision is the final decision. For example, Mobile tower guidelines are initially executed by the central Government of India and followed by the state authority. Though telecommunications-related issues are managed by the Telephone Regulatory Authority of India (TRAI) and their guidelines are applicable all over India, the states, according to their needs, modify and change it in practice. The mobile tower cannot be established near a hospital or residential area. The Cabinet mainly takes these decisions. If a technology violates society's existing rules or norms, it must be modified. After proposing a particular project, it goes to the Additional Chief Secretary, then Chief Secretary, Departmental Ministers, Chief Minister, and placed in the Cabinet. If it is approved in the Cabinet, it comes to the IT Department.

3.9 Exclusion in social inclusion projects: Perspective from the concept of 'Digital Divide.'

Data on the development and growth trajectories of many developing countries reveal undue favors to some specific groups, which have resulted in some kind of divide. The high cost of technological innovation, access, and ease of adoption of technologies are the chief reasons for such non-inclusion. Inequality in ICTs is termed 'Digital Divide' (Kleinman, 2005). This inequality exists because of the different contexts under which the innovation and diffusion of ICT development took shape. In this study, it was observed that there is no sharp division between computer-haves and computer have-nots (Warschauer, 2003), but different degrees of digital divide exist.

Though the adoption of new technology in the government department depends on the actual need of its various stakeholders, it also brings some uncertainties among different stakeholders. Confusion is seen regarding compatibility and impact after adopting an innovation—those who are skeptical about the influence of ICTs are found as a late adopters. Here, age is seen as one of the causes of not appreciating it. Those who will be pensioned off after one or two years are not interested in taking the risk. If there is a need to use ICTs related activities, they seek help from the computer operator who was type write earlier. Co-existence of both modern and traditional file management systems is also one of the causes of not accepting this new technology. People like to act according to how they are comfortable—people who feel oppressed and exploited only seek changes.

In this study , it is observed that with the cognitive element such as age, other elements also take part in shaping the ICT innovation. Among them, social and technical elements are playing crucial role either guiding or constraining individuals while constructing meaning towards adopting ICT innovation. Lack of material access is also a form of digital inequality in the departments. A training program was conducted for two days in 2007 but at that time employees were not provided systems. They were provided systems only in 2016. One of the respondents from the Agriculture Department, Government of Assam, informed that whatever was taught at that time he cannot remember now. On behalf of him, the computer operator does the ICT-related work. Therefore, he is not interested in learning a new thing now and is more comfortable with the traditional method. Here language seems to be an obstacle to using it. Considering this, the innovators have developed some local apps that can be used by using the Assamese language. From the study, it is observed that it is in its initial stage almost in every Department. Therefore, there are many scopes to develop it or design it according to the need of the organization's structure. Notion of fear is seen one of the

cognitive elements that inhibits individuals to adopt a new idea. The e- district project is not able to include everyone to be a part of it, because individuals mostly from rural areas show reluctance to provide personal information while applying for any Government document through common service centres. One of the respondents from policy makers says that if people are doing a particular work in his or her own way and is comfortable then they do not easily go to accept other ideas. If people are comfortable with their existing situation, they don't want to take risk. Those who actually feel oppressed, deprived they demand change or easily accept the alternatives. The ICTs services as suggested and implemented by the Rural and Panchayat Department, Government of Assam has been seen accepted by the beneficiaries. The reception of ICTs among the VLEs are seen guided by their own personal interest. High cost of technological innovation, access and ease of adoption of technologies are considered to be some reasons for such non- inclusion. Economy is an important factor while studying shaping of an innovation in a society. Infrastructure is included in budget, but sometimes government is not able to allocate money for the sustainability of the project. Due to lack of budget allocation some projects are seen not so successful. Digital Divide that is a new form of inequality exist both within and across the departments are also created by the government policies and initiatives itself. One of the respondent from the Department of Agriculture, Government of Assam let us know that one Assistant Block Development Officer is assigned against 1000 population of a particular locality. Non-inclusion in this study is seen also as a result of (from respondents' perspective)-

- a) Gap between number of public extension functionaries and large population of beneficiaries
- b) ICT capabilities of extension Functionaries.

As different departments have assigned only one Assistant Development Officer to look after the technology matter among 1000 beneficiaries of a particular area therefore, the departments has been trying to increase the number of these field level executives. Another gap has been identified in the departments that some of the field level executives are not holding any formal degree on computers. Therefore they may not be able to solve all the technology related issues of the beneficiaries.

3.10 Conclusion

This chapter aims to look at the social embeddedness of ICT in some of the departments of the Government of Assam. This study found that ICT implementation in an organizational context is not only about the technology itself. Instead, it is a combination of both social and technical elements. To make ICT a part of the organization's routine, it has to be technically advantageous, i.e., a relative advantage in Roger's language to replace the old pattern. While doing so, it is shaped by individual actions, the culture of the particular department, and the political process. ICT as a social innovation has also established human interaction both inside and outside the departments, which is crucial for the innovation to be supported and diffused through specific channels. Governmental activity differs between the developed countries in comparison to a developing country like India through an important dimension. Extending provision of facilities to unconnected parts of the geography is important in the context of a developing country like India. Governments in the developed world are using ICTs to ensure that among other differences between the information poor and information rich is addressed through mediates that is available through resident infrastructure at the local level. On the other hand, emphasis within the developing country context is to firstly develop through which delivery of basic services could be delivered as well as to ensure reduction in any disparity between the haves and have-nots.

The traditional decision making model where government decided on behalf of citizens and sought acceptance of such decisions through publicity measures, is gradually becoming obsolete. In democratic structures of governance, it is no longer sufficient to decide – announce- defend policies. Such models of the role of government are being challenged by the contrary position whereby the citizen is taken to be a partner in the decision making process.

The central Government of India has becoming hosts for audio-visual discussions through their websites. In this study government is seen as an enabler rather than a provider of services. The enabling role is also based on a certain amount of selling of services, rather than being generally made available for free. “This is not just a matter of technology, but really of bringing in a paradigm shift in government departments.

Hard (1993), treated social conflict as a cause of innovation, diffusion, transfer and application. This approach has criticized the functionalist understanding of technological system that describes the social acceptance of existing technologies. According to this approach, ‘technology is formed by social groups in conflict and that technological change is never a socially neutral process’.

ICT innovation in this study is seen as an outcome of human action such as design, development, appropriation and modification. In every organization ICT innovation can be termed as ‘social innovation’ as it establishes new ways for cooperation between people who work and interact in organizations for common interest. Innovation in service delivery and organizational internal activities is known as a novel set of behaviors, routines and ways of working which are incorporated for improving administrative efficiency, cost effectiveness or user experience and these are implemented through planned and coordinated action. In this study it is observed that ICT facilitates and constrains human action through the provision of

interpretive schemes, facilities and norms. In a government department ICT is diffused among the employees through specific stages that comprise *Initiation, Adoption, Adaptation, Acceptance, Routinization and Infusion*. Institutional properties influence humans in their interaction with technology, intentions, professional norms, state of the art in materials and knowledge, design standards and available resources (time, money skill). Interaction with technology influences the institutional properties of an organization through reinforcing or transforming structures of signification, domination and legitimation. *By applying Giddens 'Structural dualism' Theory in this study, we can draw a conclusion that both structure and action of individuals influence the creation, use and institutionalization of ICT within and across the government organizations. In this study it has also been observed that the creation and the diffusion of ICT within and across the government departments have not reached their closure point and its an ongoing process of development.*

ICTs, Organizational Change and Selected Departments of the Government of Assam

4.0 Introduction

This chapter aims to look at the consequences of ICTs on different departments of the Government of Assam. Further, it examines how ICTs have impacted complex, rule-based organizations, also known as formal organizations.

The sociology of organizations has introduced sufficient theoretical and empirical work in Western societies. Weber is considered a pioneer in the organizational study, which has manifested a new social order. Post-Industrialism refers to how a change in work can affect organizational structure.

Owing to globalization, organizations and workers have seen an increase in the need for flexibility. Flexibility here carries two meanings: a) static flexibility- the ability of an organization to adapt to market changes; b) dynamic flexibility- the capacity to adapt to the changing needs of the market as new opportunities arise. The escalation of ICTs is seen in changing organizational structures and activities. Organizations can track activities, expenditures, and inventories more accurately by integrating information systems. Organizations can also reduce costs by delivering products and services on time through greater efficiencies. In addition to transforming existing work, ICTs have also created new forms of work. As new forms are incorporated into the existing organizational structure, it also transforms it. Along with the design, social informatics also include the study of the

consequences of information and communication technologies. The inclusion of ICTs for public access is an outcome of public policy in the Indian context of Assam. Before discussing the impact of ICTs on different sectors/ departments, it is essential to look at what organizational change is. In his discourse on the impact of technology in general and ICT in particular, Sarukkai (2008) identifies three broad positions - a) technology is culture neutral: technology operates independent of culture; b) in the intermediate position, Sarukkai asserts that technology absorbs cultural elements from different cultures while being very context-specific; and c) in the third position, Sarukkai mentions cultural determinism as the position in which cultural elements completely determine technology. Technologies are seen in their completed forms, and they perform the functions they are designed to perform. Also, he believes that the main feature of IT is that it is humanlike, although in many ways it differs from us in profound ways. Understanding the role of IT means understanding that these technologies are tools and agents of change under human control. Consequences are the changes that occur to an individual, organization, or social system due to the adoption or rejection of an innovation (Tan, 2004). Based on that, this study will look at the consequences of innovation in terms of individuals, organizations, and the social system. Changes to organizational form and function generally accompany an introduction of Information Technology into an organization. Actor-Network Theory focuses on agents' actions, and the constructivist perspective examines the technology-organization relationship and views technology as interpretively flexible. A close relationship between technology and its social context was first suggested by the socio-technical researchers in the 1980s, who put forward the concept of Information Systems as a Social System (Kelly and Land, 2004). Organizations (given structure and an emerging pattern) are a place of continuous progress that includes human action. Change in organizations is renewing the habit and action of an individual to accommodate new experience (Tsoubas and Chia, 2002) in an organization

comprising dimensions such as -specialization, standardization, formalization, centralization, and configuration (Pugh. et al., 1968). While studying the impact of ICTs in an organization, it is fundamental to identify the individual's behavior as it is expected to be a critical factor in shaping the evolution of the human being in the network society (Prigogine, 2000).

Scholars like Orlikowski (1992) and Avegerou (2000) concentrated more on the process of change in an organization than the outcome of ICTs expected to bring organizational form and function.

Organizational change has been characterized as, first and foremost, an interpretive process and people act on their interpretations of the world (Berger and Luckman, 1967). People's understanding must change if their actions change substantially (Davidson, 2006).

Public sector modernization introduces information technology that goes by the name of the e-government. It has lessened the difference between public administration, new technology, and changing administrative methods. Since new technologies give rise to new modes of production, in turn, generate new kinds of work practices under different conditions, and within different IT/ ICT implementation strategies, jobs may become more or less skilled, workgroups may gain or less flexibility, power may shift to or from central administrators and so on (Nygren, 2012).

Diffusion of Information and Communication Technologies in developing countries needs an everyday use and specific organizational features to support this process. Information System innovation system in developing countries introduces the transfer of technologies and organizational practices. Information Systems studies are contextual as they address technology implementation and use issues within organizations rather than in a laboratory setting. Therefore, Information system research considers a changing unity within its

environment. Tension exists between technologists and social thinkers because of the impact technology and innovation has on social values and the norms which are often viewed as damaging the cultural fabric of a nation or society. Though the outlook of economic development is expected to be modern and contemporary, it should also address all-round growth and well-being in the society. Growth is expected to be inclusive in nature, without any bias towards particular socio-economic groups. However, data on the development and growth trajectories, of many developing countries reveal undue favors to some specific groups, which have resulted into some kind of divide. High cost of technological innovation, access and ease of adoption of technologies are considered to be the chief reasons for such non-inclusion. Information and Communication Technologies being the most-adopted and accepted technologies is at the core of this debate which on other hand has also affected the major changes in social and political systems in many countries in the recent past. Also many other product and process technologies have affected favorably or otherwise the skill, livelihood and social norms in specific norms.

Social innovation from the sociological perspective has been investigated with regard to its significance in changing social practices, and structures and leading therefore to social evolution and social change. Social change in the sociological context is understood as a process involving far reaching changes in society, which may or may not be socially desirable, rather than the well-being and the improvement of quality of life of people.

4.1 Consequences of Innovation according to the diffusion literature

In terms of both theoretical and empirical aspects of technology diffusion, the literature is extensive. The seminal works of Joseph Schumpeter (1934) introduced technology into economic science. In spite of its innovation, Schumpeterian analysis did not receive much attention, mainly because of its high theoretical, strict, and simplifying assumption about the

linearity of the diffusion process, along with ignorance of the distinction between invention and innovation (cited in Ziemnowicz, 1942).

Hostettler (2016) mentioned different types of innovation such as product innovation, process innovation, market innovation, organization innovation, and social innovation. Originally innovation meant 'restoration' or renewal. To be called an innovation, an idea is expected to bring positive change and must be able to satisfy some specific needs. In the context of development, social innovation can be defined as a novel solution to a social problem that is more efficient, effective, sustainable, or just than current solutions. The value created accrues primarily to society rather than to private individuals.

Both adoption and rejection of a particular innovation lead to consequences on the individual and social system. The consequence of innovation in the diffusion literature has been paid little attention to as it is difficult to predict at what time and how the consequence may appear. Change agencies that implement innovation for the upliftment of the socio-economic condition of a particular society always have a pre- innovation assumption that innovation can bring only positive change. Research on innovation and its consequences has relied on the survey method more than the in-depth case study approach. As consequences cannot be measured, it may lead to an incomplete and misleading end. Therefore, it is suggested that the concept of '*cultural relativism*' should be used to measure the consequence of innovation of a particular social context where agents are flavored by their norms, values, beliefs, and attitudes. As consequences of innovation are not one-dimensional, Rogers (2003) has divided them into three dimensions-

- a) Desirable vs. undesirable;
- b) Direct vs. Indirect;
- c) Anticipated vs. Unanticipated.

By applying Roger's model of examining the consequences of an innovation, this study tries to look at the impact of ICTs on various departments of the Government of Assam, focusing on individuals, organizations, and the social system.

4.2 Desirable consequence

Desirable consequences are defined by Rogers (2003) as the functional effects of implementing innovation on an individual or a social system. The consequences of a new method or practice in an organization are rarely ultimately desirable or undesirable, so there is often a high tendency to evaluate and measure the functional contribution of some new method against the dysfunctional effects because innovations have a propensity to dislocate the older, more conventional methods or technologies. Social innovations are perceived as intentionally designed tools that target specific goals. According to authors, a social idea or social invention turns into a social innovation only when it becomes widely accepted and is being used in a social system, or, put in other words, when it gets institutionalized or transformed into a social fact through planned and coordinated actions. Social innovations are disseminated by the market, social networking, movements, governmental guidelines, supported by foundations, and charismatic individuals or social entrepreneurs. Stimulation of development through science and technology will not come about through an instant and massive transfusions of Western know-how. The industrialization also demands a strong and lasting political consensus (Carey, 1978).

For development purpose, Science has to act at the interface of many frontiers that include not only knowledge but technology, society, politics and development. Modern science and technology were expected to accelerate their development and even to bridge the gap between the former colonial powers and the new independent states. In 1963, the United

Nations organized a conference on the application of science and technology for the benefit of underdeveloped regions.

“Science and technology are not simply to be applied to developmentThey are an essential part of development. They are inextricably bound up with the social, economic and political parameters of development.”- argued by Dr. W. K. Chagula, former chairman of the Advisory committee on the Application of Science and Technology (Berlinguet, 1981).

4.2.1 Communication without intermediaries

Respondents of the concerned departments informed us that ICT has reduced or replaced human labor in intra and inter- Organizational activities. The traditional meaning of innovation is 'restoration' or renewal, and Joseph Schumpeter is the first economist who emphasized the importance of innovation. According to Schumpeter, Innovation is the new method, idea, or product, and it is assumed that innovation can bring only positive changes. "To be called an innovation, an idea must be replicable at an economical cost and satisfy a specific need. Research on innovation and Diffusion articulates that obtaining the desired consequence of a particular technology is more challenging than making a successful one more influential. Innovation has to transform as technology, and it must be used on a targeted population at a larger scale. The focus must be given to need assessment to know the appropriate applicability (Hosteller, 2016).

One of the concepts of Rogers (2003) is Relative advantage, which refers to the degree to which an innovation is perceived as providing more advantage than its antecedent in terms of efficiency, economic benefits, and enhanced status. Past research has found that the relative advantage of an innovation is positively related to the adoption rate (Moore and Benbasat, 1991). Research suggests that when users perceive the relative advantage or usefulness of

new technology over an old one, they adopt it. The study's organizations are seen in a state of flux, where the traditional system development and operations activities are supplemented with newer activities such as data administration, network management, and information center services. Pieces of literature have let us know that organizational innovations lag behind technical innovation. In comparison to technical innovation, administrative innovations are not so observable and have a lower level of triability, and they are perceived to be more complex than technical innovations (Swanson, 1994).

In this study, it is observed that ICTs have both material and social properties and are used to achieve specific goals of the organization. We treat ICTs as a value-neutral artifact used to replace traditional office management systems through the project named 'e-office. ICTs are also exercised for reporting, supervision, monitoring, and controlling the department's activities. ICTs have also brought changes to provide services, i.e., ICT-based communication with actors outside the organization. ICTs have also brought changes towards knowledge management, helping an organization identify, collect, manage, distribute data and enable adoption. Using ICTs, the departments collect data on available resources, GIS systems, climate change, pollution. ICTs have helped to establish interaction and collaboration both externally and internally.

In 2007, ICT was introduced to the health sector. Health Management System (HMS) portal was the first application of IT introduced in 2008. The Indian Government organizes a 'Best Practice Workshop' to inform the states about new IT applications in the health sector at the national level. There are two call centers under the Department of Health and Family Welfare, the Government of Assam – Health Service Information System (104 services) and Emergency Service Centre (108 services). These two call centers have incoming call service facilities, and the Mother and Child Tracking System (MCTS) has an outgoing health service

delivery call facility. This call center offers pregnancy and Infant Care services to the public. People can get information regarding due dates of services, including vaccine dates. Although the Government of India provides software for the community development program, e-Hospital is another IT program for the management of hospitals. While it was asked about the consequence of ICT in the Department of Agriculture, Government of Assam, one of the senior employees of the department says that he has been working since 1990 and he has seen the impact of ICT in the department. ICT has brought positive changes to the department's activities by making the functions very fast. The use of ICT has made the file management system transparent. Tracing of files has been made easy by the online file management system. The employees are updated about the new schemes. Information is provided for the benefit of the farmers on time. Another respondent from the same department says that the introduction of ICT is helping in reducing the misuse of paper material in the department.

E- Panchayat, a Mission Mode Project, was implemented by the Department of Panchayat and Rural Development, Government of Assam 2015 in rural employment generation program, poverty alleviation program, and the Pradhan Mantri Awas Yojana Gramin (PMAY-G). As mentioned earlier, functions such as allotment of money, monitoring the schemes, making bills, and vouchers related to the schemes are done through the e- Panchayat project. The project has been introduced to replace the manual or traditional resource allocation method for beneficiaries of a particular area. Till now, PRIASoft, National Panchayat Portal (NPP), Local Government Directory (LGD), Plan Plus, Action Soft, Area profiles, National Asset Directory (NAD) have been introduced to strengthen e-Governance in Panchayati Raj Institutions (PRIs) in the state and build associated capacities of the PRIs for effective adoption of the e-Governance initiatives. These systems maintain beneficiary data, photographs of beneficiaries and schemes, vouchers, financial data. These information

systems also include data of transfer of funds directly into accounts of beneficiaries using Digital Signature. One of the Department of Panchayat and Rural development respondents says that now the focus has been on making app-based services that people have found easy to use. While constructing the house under the PMAY-G scheme, the field officer had to go to the village for inspection, and the concerned officer was asked to take a photo and keep it in a file. Then the check is issued by the Block Development Officer. Then the changes came with the application of ICT, and it replaced this time-consuming and not transparent method of poverty alleviation. Now the BDO has no power to authorize, and with the application of ICT, the beneficiaries have to upload the photographs of the locality by clicking it geotechnical, the progress of the house by using that particular app (Awas App). This app is designed so that for that particular beneficiary, the application will be enabled only in that particular place. Another instance of ICT use in this esteemed department is *biometric signature verification*. Those engaged in the department's field-level activities found it challenging to use. A specifically designed app is used in the Department of Panchayat and Rural Development, Government of Assam, to capture the employee's location and signature. He/she is monitored whether the signature is coming from a particular place every day. One of the respondents from the Department of Panchayat and Rural Development, Government of Assam, says that ICT has brought many changes to the department. Now employees can login through their respective accounts and apply for leaves.

In comparison to other applications, the employees are finding it easy. Earlier it took much time to sanction leave. Now it can be done quickly.

4.3 Undesirable consequence

Innovation means an improvement on the old. It is expected that the outcome must benefit both the innovator and the user. Rogers (2003) identified these statements as a misconception

of innovation or the pre-innovation bias. By undesirable, it means undesired to the stakeholders of the innovation. "Most of the undesirable consequences emerge when the innovation is widely diffused and never comes to the attention of the innovator (Rogers, 2003). Innovation might seem beneficial initially, but its consequences can be known when it diffuses more stakeholders. Therefore, longitudinal methods are suggested to study innovation's undesirable and unanticipated consequences. Lack of knowledge, resistance to change a habit are some of the causes of undesirable

outcomes of innovation. Undesirable consequences are not wanted by either the agent or the stakeholders of the particular setup where the innovation is implemented. These consequences are also termed dysfunctional consequences. Rogers argues that innovators generally want to avoid the undesirable consequence of innovation.

4.3.1 Exclusion in social inclusion project

In the European context, the uneven adoption and use patterns of ICTs, i.e., 'Digital Divide,' is a division of 'digital haves' and 'digital have-nots.' The US Department of Commerce (2000) has outlined a dichotomous divide between those connected citizens and those who remain discounted from Information Technology.

[Some individuals] have the most powerful computers, the best telephone service, the fastest internet service, and the wealth of content and training relevant to their lives. Another group does not have access to the newest and best computers, the most reliable telephone service, or the fastest or most convenient Internet services. The difference between these two groups is the Digital divide.

Nevertheless, Webster (1995) argues:

[To] distinguish between the 'information rich' and 'information poor' both avoids precise delineation of who these are and fails to consider the range of different positions...In short, the model lacks sufficient sociological sophistication.

In Warschauer (2003), bridging the digital divide is not only about technology but also about the social, political, and institutional factors that affect people's adoption and use of technology.

Though ICT is expected to increase industrial productivity, facilitate tourism, improve the delivery of social services, allow educational services to reach out of the way places, improve government accountability, provide needed data to isolated farmers, foster a worldwide civic society, and mobilize social movements. However, these optimistic cyber predictions stake over a complicated reality (Kleinman, 2005).

New technologies create new potential and new opportunities that change our notions and expectations about what is possible and what is not. From 'Social Construction of Technology' perspective Warschauer (2003) states, 'What is at stake is not access to ICT in the narrow sense of having a computer on the premises but rather access in a much wider sense of being able to use ICT for personal or socially meaningful ends.' He shifts the focus beyond the limited scope of computer ownership and internet connection haves and have nots, reorienting the focus of the intersection of ICT and social inclusion. Earlier notions of the digital divide focused only on computer ownership and internet connection haves and have nots. Warschauer has referred to the work of Cisler(2003), who argued that the digital divide is a distinction between the haves and have nots, but it is a division based on the degree of access to information technology. The process of social differentiation is much more complex

and cannot simply be explained away by a model of dualism. There are seen disparities in access to and use of new information technologies as we live in a highly stratified society. It is argued that different aspects of socio-economic stratification are reflected through the digital divide. Technologies diffused through stratified social formations are likely to produce differential impacts (Saith, Vijayabaskar, Gayathri, 2008). Patnaik has tried to state the socio-cultural effects of ICT revolution in India from sociological point of view. He identifies some issues of social stratification that emerged because of introduction of new technologies of ICT. He has also talked about how this new revolution contributed to form new class of occupation i.e. ICT knowledge workers. He has also mentioned how the phenomenon of Embourgeoisement that strengthens the bourgeois values among the ICT knowledge workers. Like capitalism, a new form of working class consciousness also developed among the ICT knowledge workers.

The digital divide is seen as a very complex and dynamic phenomenon. Some of the barriers to access to Information and Communication technologies have been identified, such as Lack of Elementary digital experience caused by lack of interest, computer anxiety, and unattractiveness of the new technology (Mental access); No possession of computers and network connections (Material access); Lack of digital skills caused by insufficient user-friendliness and inadequate education or social support; Lack of significant usage opportunities (Malhotra, 2011; Rao, 2005; 2005; Singh, 2010). In this study, it was observed that the digital divide as a new form of inequality came out due to ICT innovation and Diffusion. There is not any single cause of this differentiation. Nevertheless, this division has different grounds. The adoption level differs because of lack of interest to use a new thing, fear of learning a new thing, lack of material access, lack of digital skills.

Institutional properties influence humans in their interaction with technology, intentions, professional norms, state of the art in materials and knowledge, design standards, and available resources (time, money, skill).

When trying to introduce a new thing, there is always the first thing, there is a fear, what to do or what not to do, confusion regarding whether it could be done. Different factors can affect the discussion of innovation processes and the products associated with each sector. These factors relate to characteristics of the user community (job tenure, education, resistance to change), characteristics of the organization (specialization/centralization/formalization), characteristics of the task to which the technology is being applied (task uncertainty, autonomy, and responsibility of person performing the task, task variety) and characteristics of the organizational environment (uncertainty, international dependence). First, people have to make sense of it to interact with technology. Therefore, they develop particular assumptions, expectations, and knowledge of the technology, shaping subsequent actions. As the interpretations become taken for granted, then people act toward technology.

Some people are seen protecting existing practices rather than paying attention to developing new ideas. Then the problem arises in processing ideas, i.e., implementation and institutionalization of new ideas. Problem is seen in managing post-whole relationships. While transforming an innovative idea into a concrete reality, multiple functions, resources, and disciplines are needed. Most individuals lack the capacity and inclination to deal with complexity. They think that using ICT in their daily activities will make their job more complex.

It is commonly believed that older adults have a distaste for technology, while today's youth are interested in mastery. Nevertheless, new technologies are being adopted every day for more excellent operational benefits to be obtained in the department, which has compelled

the grandsires to painstaking struggles to do well all know, age-related changes create troublesome physical and mental conditions in one's life, including slowing ability to make continuous motion and adoption to new things.

One of the respondents from the Agriculture Department, Government of Assam, expressed that most employees do not accept changes with ICT in their department. If people are doing a particular work in his /their way, he remains comfortable with that and not interested in accepting other ideas. Again the respondent stated that those who feel oppressed, deprived look for change. The people who are comfortable with their existing situation do not want to take the risk. Change for them creates problems as they have a vested interest in them. During the conversation with a high-ranking official, it was told that using the traditional method was more comfortable for her. For her, it is more time-consuming such as checking emails. Therefore she wants to go with the traditional method. Age is also a factor.

As she will be retired after a few months, she does not find any reason to use ICT for the department's daily activities. She used the term '*irritating*' when it comes to ICT. Ultimately, it is her personal choice not to use ICT though she holds a top rank in the department. Another respondent from the same department who has been working since 1990 commented that He went for training but was not interested in using ICT for the department's daily activities. The training was for two days. In 2016 training for the employees was provided, but at that time, employees were not provided systems. Therefore, whatever was taught at that time, he cannot remember now. On behalf of him, the computer operator does the ICT-related work. Therefore, he is not interested in learning a new thing now and is more comfortable with the traditional method. Those engaged as typewriters in the department are providing service as computer operators. The senior employees are seen taking help from computer operators. It may also be a cause of creating this division. Another critical

characteristic of Roger's Diffusion of innovation model is Compatibility which means the level of Compatibility that innovation has with folks as they incorporate it into their lives. Targeted adopters must be aware that the innovation will be well-matched with their lives and lifestyles. If innovation requires a huge lifestyle change or the user must acquire additional products to make it work, it is more likely to fail. Innovations meet with tremendous success when users can seamlessly adopt them — when they replace an existing product or idea for the better.

4.4 Direct Consequences

Direct consequences alter an individual or a social system that immediately responds to innovation. Schumpeter's idea of creative destruction, Kuhnian paradigmatic revolutions all demonstrate the transformative capacity of technology. (Toffler, 1980). The reform of government administration and enhanced services to people have long been recognized as the primary measure for development, and today's drive towards e-governance can be considered a part of this development goal. Madon has mentioned about two phases of e-governance in India. The first phase is from the 1960s-1970s to the late 1990s, and the second phase starts from the 1990s. In the first phase application of IT was confined only to government activities such as defense, research, economic monitoring and planning, tax administration. The second phase characterizes a paradigmatic shift in e-governance policies that includes IT in different sectors to reach everyday people both in rural and urban areas. He has adopted a constructivist approach to study the development impact of e-governance initiatives in India. He mentioned the works of Heeks (2001) and stated that a 'networked readiness criterion' is necessary as a strategic tool to support access and usage of the technology. E-governance was introduced in India in 2001, but Madon has been working since 1988 on IT projects in India. Madon used Sen's capability approach to assess the relationship between policy discourse on

e-governance and how the capabilities of individuals and organizations shape the implementation of these projects. Technology and Technologists usually carry a spectacular promise of problem-solving, overcoming resource constraints, generating growth, and delivering development (Saith and Vijayabaskar, 2008).

4.4.1 Change in the employment structure: an instance of direct consequence

Smircich (1983) argues that the concept of 'culture,' borrowed initially from Anthropology, applied to analyze shared knowledge, a system of shared meaning, and an expression of the mind's unconscious operation. In this metaphor, culture is conceived of as a pattern of symbolic discourse in organizational analysis. In this regard, culture should not be viewed as a set of variables that societies possess but as an active, living phenomenon through which people creates and recreate the world in which they live.

In an organizational context, the enactment of meaning is a collective activity, at least partially, and thus cultural 'structures' or structures of shared meaning are created within the organization. The structures condition the enactment process at later times, but because of the fluid and changing nature of the process, structures become modified and recreated during enactment. The complex link between action and structure has been explored by Giddens (1984) in his 'Structuration Theory.' This theory emphasizes that action, which has strongly routinized aspects, is conditioned by existing cultural structures and creates and recreates those structures through the enactment process. Thus the creation and recreation of culture is a dynamic process linking action and social structure.

Orlikowski and Robey (1991) have discussed the interaction of information technology and organization by developing a scientific framework based on Anthony Giddens' theory of Structuration. The authors have tried to establish the relationship between structure and

action to focus mainly on the creation, use, and institutionalization of Information Technology within an organization. By challenging the debate over the opposition of subjectivity and objectivity, Giddens postulates that while studying social reality, both are equally important. Changes in employment structure and diffusion innovation process of an organization are found co-constitutive in the study.

Changes have been observed in the employment structure. When ICTs were introduced in the government departments, those proficient with the traditional working method could not deal with it. Therefore, People were hired from private enterprises on a contractual basis, such as EPITOME- Computer Training School, NIIT Guwahati. To work with NIC also, it was necessary to hold B. Tech / BE degree, especially in Computer Science. Again, it was observed during the study that a new post has been created within the departments called 'computer operator' who look after the IT-related functions of the concerned department.

Interestingly these computer operators acted as 'type writers' of the department. While asking why keeping this post in the department, we were told that "some issues are involved while adopting a new idea such as fear, anxiety, lack of interest. Age group is an essential factor here. People of a particular age group are not interested in adopting a new idea. Sometimes those who have been working with a traditional method for a long time are thinking about what to do to learn new things as they are not going to use this anymore, and there is no need to take some extra burden before retirement. This category of people who have exempted themselves from taking risks in using a new idea seek help from computer operators to perform their ICT-related activity.

A new post has been created outside the department named Village Level entrepreneur appointed by the Government. These VLEs work in the Common Service Centre (CSC), established to bridge citizens and the Government. Shared Service Centers have the aim to

provide government services to citizens. The CSCs are run by a person of a particular village who has computer knowledge to some extent. Government and Government do not appoint the person, and he is seen as self-sustained. When asked about selecting a person from a particular village rather than appointing a government employee, the respondent said that as the VLE is the key to the CSC operations' success, the VLE should be carefully chosen. If a government employee is selected who is an outsider to the village, they may not be able to identify the local needs of that particular area. If a person is selected from his/ her area, there would be a strong social commitment and respect within the community. Another reason for selecting VLE from his/ her village is that a government employee is a salaried person; therefore Government has to pay him/ her even if he fails to provide the necessary services to the villagers. Therefore the CSC scheme was designed so that the revenue generation of the VLE is directly related to the services that he/ she provides to the community. Apart from providing Government services to citizens, the VLE also provides Business Citizen Services. The VLE is provided infrastructures from the Government and the computer the VLE has to manage independently to run the business.

The respondent has pointed out that earlier employees were graduates only. Only a few had type writing knowledge. Now people are recruited based on particular skill or knowledge on computer. While asking about the changes in employment structure, one of the respondents says that ICT has brought occupational structure to the departments. The departments have increased the post for contractual jobs. The occupation structure defined by one of the high-rank officials of AMTRON as an Information and Communication Technology Minister is at the topmost position. Then Chief Secretary, Additional Chief Secretary, Commissioner, Joint Secretary, Superintendent, Staff. Within the IT department, the PSU is AMTRON, headed by a board of directors where the chairman is the honorable IT Minister. Other government

officials from various departments are members of this board. There is a managing director who runs the day-to-day activities of the organizations. There are two managers under the managing director, but there is one manager now. There are deputy managers, additional managers, and Asst. Manager.

As the main functions of these departments are performed by using ICT, therefore, at the time of recruitment, preference is given to experts in this area. In the decision-making process of IT-related activities, some people may not have a certificate in IT knowledge, but they may be included in that process depending upon their experience on that particular matter.

4.4.2 Social interaction: an additional direct consequence

According to Holt (1971), innovation is concerned with change, and there can be a distinction between technological innovation and social innovation. Technological innovation, according to him, is the application of new technology, whereas social innovation is connected to the application of new social patterns of human interaction. The use of ICTs innovation is no longer a technological matter involving the development of technical solutions in a government department but as a process involving social interactions. The ICTs innovation and subsequent Diffusion are not merely understood by the combinations of tangible forms of capital (physical/financial) but also by intangible forms such as social capital. The Diffusion of ICT innovation depends upon the individual's interest, but in an organization, it is seen developed through personal interaction, and this interaction process is necessary while motivating the fellow members of a department to adopt a technology.

This study observed that incorporating ICTs as a part of the departments' daily activities has created some new form of interaction among different actors. This interaction is seen among innovators, implementers, policymakers, and end-users.

The Diffusion of ICTs starts with the process of technology transfer that includes three different stages, and each stage comprises different sorts of interaction-

- d) Transfer information on the stakeholder's need for new technology to the research system.
- e) Transfer of results to development agencies/ government departments.
- f) Transfer of results to the stakeholders.

AMTRON and NIC, two foremost research organizations in Assam, perform the responsibility for conducting research relevant to the communities' technological requirements. The extension agencies perform the crucial function of collecting information on stakeholders' technological requirements, which generate the research and then prepare a package of inputs consisting of research results and supports physical and financing input. Finally, the department offers the package to the stakeholders and the community to promote inclusive development. The stakeholders may then accept or reject this package depending upon the characteristics of the innovation and the ability of the innovation to address their needs. Interaction between these groups shapes the flow of physical resources and funds and the flow of communication. In the case of agriculture, the introduction of the Green Revolution in the 1960s was the starting point of introducing technology to relieve the food shortage, and this showed the transfer of the new technology from the research institute to the farm. Before coming of ICT in agriculture, different technologies were provided by Assam Agricultural University, Jorhat. The respondent let us know that at that time, the department of agriculture was like a field of the experiment of technologies. Some of the respondents said they found difficulty dealing with the new technology at first. They tried to tackle it by seeking help from peers or family members. When it was asked about the nature of internal

support that required to motivate the employees of the department, one of the early adopters of ICT innovation revealed that "Had I had the hammer with me all the time, it would have been tempting for me to treat everything and everyone as if they were some nails, for men have been struggling to overcome the temptation of doing the cakewalk. In reality, what I want is to make the things like the lives of crops, which are to be reaped in due time. Their growth depends upon how you nurture them". Interaction also takes place between industry and academia.

AMTRON maintains its function in collaboration with Cotton State University, Gauhati University, and the Indian Institute of Technology Guwahati. While it was asked about the interaction established after making ICT a part of the department's activities, we know that those who are late adopters of this innovation see help from the younger ones. Here age is a determining factor of this division. In the online file management system, everyone has their account, and if he/ she is not interested in using this for the function, a minimum effort should be given to operating their system. For the rest, they are allowed to seek help from the existing computer operator in the department and the 'junior.' A frequently used phrase by the senior official to their junior, " Hobo dia, imanbosoramienekei Kari asu, tumalukdekamanuh, Kari dia sun murkhinio." [we are doing our work in this way for a long time, what to do now to learn a new thing, you people are young; along with yours do mine also]. Another respondent says that they are helping each other in the department for their upliftment and the organization's development. As they stay in the department for a limited period, they sometimes seek help from their family members, especially their son and daughter. It has been seen that this interaction is not confined to only the concerned department but goes beyond the departments.

4.5 Indirect Consequences

Tension exists between technologists and social thinkers because of the impact technology, and innovation has had on social values and norms, which are often viewed as damaging a nation's cultural fabric of society. Though economic development is expected to be modern and contemporary, it should also address overall growth and well-being in society. Growth is expected to be inclusive without bias towards particular socio-economic groups. However, data on the development and growth trajectories of many developing countries reveal undue favors to some specific groups, which have resulted in some kind of divide. The high cost of technological innovation, access, and ease of adopting technologies are the chief reasons for such non-inclusion. Information and Communication Technologies being the most- adopted and accepted technologies is at the core of this debate.

On the other hand, it has also affected the significant changes in social and political systems in many countries in the recent past. Also, many other product and process technologies have negatively affected the skill, livelihood, and social norms in specific norms. Social innovation from the sociological perspective has been investigated concerning its significance in changing social practices and structures and leading to social evolution and social change. Social change in the sociological context is understood as a process involving far-reaching societal changes, which may or may not be socially desirable, rather than the well-being and the improvement of the quality of life of people. Kesselring and Leitner (2008) also follow the sociological view while studying the invention and implementation of social innovations in organizations. The authors define social innovation as an 'element of social change) that create new social facts, i.e., influence the behavior of individuals or specific social groups discernably and align it with accepted- not primarily economic rationality following 'goals.' The goal-oriented character of social innovations, i. e. emphasizes the idea that social

innovations are intentionally implemented and strategic to attain specific ends. (Howaldt and Schwarz, 2016).

Because of the complicated, often unseen network of interrelationships among the elements in a culture, a change in one part of an organization often initiates a chain response of indirect consequences stemming from the direct consequences of an innovation. Indirect consequences are the changes to an individual or a social system that occur due to the direct consequences of an innovation.

4.5.1 Preference management that encourages people skills as indirect consequences

While the direct consequences are the changes that come with an immediate response to innovation, the indirect consequences are the changes to an individual or a social system that occur due to the direct consequences of an innovation. The changes in employment structure in the departments that are the outcome of the adoption of ICTs also have some indirect impact on employment structure. As the adoption rate is not equal for each individual, the departments have created a new post named computer operators who technically support the individuals within the group while performing the ICT-related activities. Before implementing ICTs in the departments, a post called a typewriter was called. Later this type of writer's post is amended as a computer operator. When highly skilled professionals are hired or recruited for the proper implementation of ICTs (for better transparency and efficiency), the existing office personnel have always feared losing their jobs. One of the respondents from P&RD, the Government of Assam, said that *'It is good because people I have started to learn.*

One of the respondents told us that a data analysis lab had been established in Khanapara, through which the concerned department can monitor their projects starting from district level

to village level. While doing these activities, they also learn about the geological issues of those particular areas that help them make policy decisions regarding those issues. While asking about the Direct and Indirect consequences of ICTs, one of the respondents said, 'as the people have once got to know how to use an application, it makes them confident enough to use an additional amount of application.

For all the workers of a particular Department, there is a WhatsApp group, including DC. If the department tries to convey any information to the DC office, they can easily do it with the WhatsApp group, which was time-consuming earlier. Another instance of the establishment of a Data analysis lab. These labs monitor the implemented projects in district block and village level. Geological issues are detected with the help of this initiative that helps the department to make policy decisions.

4.6 Anticipated Consequences and Unanticipated consequences

Innovation can be both evolutionary and revolutionary. Anticipated consequences are changes due to an innovation accepted and planned by the social system members. Unanticipated consequences are changes due to innovation that are neither intentional nor acknowledged by the social system members.

Innovation in the departments where the study was conducted cannot be seen as a new idea or only as a physical artifact; it is a new practice that establishes a new relationship between service providers and their users.

Benington and Hartley (2001) have discussed four types of relationships between innovation and improvement. There may be an improvement but no innovation. There may be both innovation and improvement. If the organization's environment is stable, there may be no innovation or improvement. If the innovation is not valuable and unsuccessful, innovation is

seen but no improvement. Some organizations appear to be more receptive to innovation than others. Organizations which implement major innovations successfully are more open to and have the structures and cultures to support further innovation (Newman, 2001).

Boudreau and Robey (2005) have tried to focus on the role of human agency while adopting computer-based information systems by a large government agency. Initially, the users were reluctant to adopt new technology, but people started to conceptualize technology differently as the use pattern changed. As a result, they accepted technology as a part of their daily activities according to their experiences and needs. Human agency has the power to sustain structures and transform the structure of an organization. Micro-processes condition an organization's macrostructure at the level of individual roles.

The author has also stated that innovation is regarded as a planned attempt that recombines old innovation. Based on effects on established patterns, innovation can be classified as follows –

- a) Continuous innovation.
- b) Dynamically continuous innovation
- c) Discontinuous innovation.

An innovation may be termed continuous innovation if it has little impact on the existing patterns. If it tries to alter the product rather than establish a new product, it comes under continuous innovation. The second form of innovation, i.e., dynamically continuous innovation, does not alter the established patterns but involves the creation of a new product or bringing changes to the existing product. A discontinuous innovation brings changes to both products and established patterns. The evolvement of Information and Communication Technologies comes under Discontinuous innovation. If the norms of a particular group favor

innovation, the innovation will be a socially integrated product of the community (Usher, 1954).

One of the senior employees who has been working as a developer of the ICT innovation for the departments of the Government of Assam says that they develop programs or schemes to reach specific goals. Nevertheless, along with the planned changes, they have to entertain some side effects (both positive and negative). Negative consequences occur primarily in the initial phase of implementing a particular project. These are mostly related to connectivity issues. When they realize that forms are coming in less number from a particular place that is remote and has poor connectivity, they immediately replace it with offline mode. Infrastructure is included in the budget.

Nevertheless, sometimes the Government cannot allocate money for the sustainability of the projects. Due to a lack of budgetary allocation, some projects fail. So it is suggested to spend at least 2-3% of the total budget on IT infrastructure. Lack of maintenance is also a reason for the failure of projects. The GM of AMTRON has mentioned conflicting issues- as equipment comes first, but non-availability of infrastructure. According to him, importance must be given to infrastructure first. The whole process of ICT innovation and Diffusion, according to him, is developed by learning through experience and mistakes. Another issue he raised- human resources are available, but the Government cannot give them a salary. In most of the cases, it is seen that according to need or current situation Government suddenly implement some new technologies but forget to look at necessary infrastructure. Every department uses IT services, but there is no standard data center. Nevertheless, now, there is a need for a repository. Therefore, AMTRON is planning to establish a Common Data Centre.

One respondent said that keeping traditional and online file management systems has created an overburdened situation when asked about the unplanned consequences of innovation in the

departments. They have to keep records online as well as manually. The respondent says that it is very time-consuming. She says, ' suppose I have to send a file physically but forget to update it online, and then sometimes it may be misplaced. If the manual method is removed, the peon will have no work; the post will be there, but less workload.

4.7 Conclusion

This chapter looks at the consequences of ICT within and across the department by using Roger's Diffusion of innovation model. Depending upon various innovation characteristics, the study shows that ICT innovation has different impact dimensions. It cannot be seen as unidimensional. The immediate effect of ICT innovation on intra and inter-organizational activities can not be measured. Rather it is preferred to study using the longitudinal technique. The impact of ICT can be comprehensible once it is diffused among a larger population. The implementation of ICT innovation in the departments where the study was conducted is still in the infant stage. It has been used to address the economic development of the entire state, taking it as a priority goal. Furthermore, this process has other impact dimensions, such as indirect, undesirable, and unanticipated outcomes.

Conclusion

This chapter is structured into three segments. The first segment summarizes the findings of the present study. The second segment outlines the significant observations of the study. The third segment is devoted to pointing out the limitations and future scope of the study.

5.1 Recapitulation of the Broad Findings

- In the 21st century, the emergence of Information and Communication Technologies has reached social, cultural, political, economic, ethical, legal, and institutional domains, and the changes resulting from this technology can be described as Postmodernity.
- The term 'Information Society' implies features distinct from those of some non-information societies. The main difference between industrial and postindustrial societies is that industrial societies use natural resources in the production process, while postindustrial societies rely heavily on information resources.
- Diseconomy is a term Kumar used to describe pollution, crowded conditions, and exploitation of resources in the name of Industrial development, and this dark side of Industrialism led to the emergence of societies like the Information Society. Hence, there was a need for a postindustrial society as an alternative method of solving the problems of Industrialism.

- As information society developed, the first phase comprised occupations related to information. Telephones, cellular phones, fax machines, and computers were introduced to accommodate specific needs in the second phase. The third phase began in the 1990s with the introduction of the internet and personal computers.
- Information became a part of national and individual development because the Modernization Theory of development holds that a country's economic development is linked to its technological development. Less developed countries must follow the same patterns of economic development as the developed ones to achieve progress.
- Since the Technological Determinism (TD) perspective leaves no room for conflict and is entirely focused on systems of power and coordination, the scholars of Social Constructivism tend to go beyond it and argue that government, social and military elements are responsible for the shaping of ICTs at the macro level.
- Some applied sciences are subtle in agencies earlier than it diffuses amongst frequent humans and ICTs are among them.
- It is common for some technologies to diffuse in organizations before they are diffused among the general population. Through innovation, organizations can cooperate with dynamism in the competitive environment, market, and customer demand. The introduction of innovation affects the organization, and other organizational notions such as job satisfaction, quality of products, performance, knowledge management, and adoption of information systems can affect the innovation process in the organization and vice versa.
- It is a social phenomenon in which individual participation in the organizational, operational system is plausible when innovation is an integral component of a large and complex organization. Today's postindustrial environment calls for faster and

more frequent organizational decisions with the creation of innovations for external consumption. Consequently, organizations need the information to decide when to make decisions and innovate, and decision-makers need the information to conclude. Organizations are expected to be more continuously innovative.

- The concept encompasses increasing demands for flexibility, building organizational capabilities, adapting to customer needs, and responding quickly to new challenges as organizations are affected by social change in the societies to which they belong. Several studies have shown that changes in the political, legislative, and economic environments are directly related to societal changes. As people occupy multiple roles and relationships, their responsibilities and authorities shift depending on which role is active and which relationships they are involved in at a given point in time.
- The adoption and Diffusion of innovation in an organization begins with a perception of a problem. As a result, existing circumstances are reinforced. Depending on its ability to demonstrate a relative advantage over the existing system, the innovation becomes part of the organization's daily activities.
- In the post-modern culture, the rebuilding of the state job has likewise been seen as ICTs have turned into a piece of accomplishing the average interest or general will of the people. Power has also been changing from customary elites to innovatively talented specialists. Likewise, majority rule nations are more open to innovation alongside institutional changes than non-vote-based countries. Every day, society can get to 'uncensored data in a majority rule government.'
- In dispersion research, assumptions have become exceptionally critical. These assumptions are joined with directing exercises, speculation, and so forth, and

appropriately, jobs are doled out, obligations are explained, and safety measures are accepted to manage open doors and dangers.

- Scholars like Alvin Toffler and Daniel Bell have talked about the experience of the society in the new form of social order that includes changes in human civilization, new economic relations including changes in the state and authority. In the words of Drucker, the main characteristic of an Information Society in the production of knowledge that was private in origin and became public.
- The technological determinism perspective was attacked because it does not allow for conflict analysis; therefore, studying the emergence and application of ICT, as well as their impacts from the perspective of Social Construction of Technology, focuses on the interaction of actors who are part of a particular social and historical context - such that the Information Revolution indicates some values, causes, and results with the transformation process.
- The term 'social' itself carries different meanings depending on its application. Some researchers focus on the individual as the crucial element of social theory, while others focus on how socially constructed institutions are shared.
- The social embeddedness perspective focuses on how the ICT innovation and development in a developing country depends on the local context, such as different organizational settings and the cognitive, emotional, and political capacities under which individuals of that particular society have been nurtured. The theories associated with the social embeddedness approach are Actor-Network theory, Structuration theory, and organizational institutionalism that establish a relationship between technology–society, agency-structure, and technical reasoning –institutional dynamics.

- The nature and design of Post Industrial societies are different from that of Industrial Societies. As organizations are seen affected by the social order of that particular society, the nature and design of postindustrial organizations are seen influenced more or less by the characteristics of Post Industrial Society where authority becomes less political, legislative, and economic environments are directly proportionate to the societal change. It focuses on increasing flexibility demands, building organizational competence, changing customer requirements, and rapid response to new challenges.
- Innovation facilitates organizations to cooperate with the dynamism of the existing competitive environment, market, and customer demand.
- The culture, norms, values, roles, and attitudes of an organization contribute to developing an innovation system. An organization's information system influences both the social features and practices of an organization. It emphasizes organizational dynamic and identity while examining IT as both a cause and an effect of organizational life.
- Innovation diffusion is impacted by expectations in Science and Technology Studies (STS), as these are future-oriented activities. Therefore, the local, state, and national level institutions, especially the state-run institutions, have introduced ICTs for the benefit of the people.
- Innovation in general and ICT in particular in Government organizations is introduced mainly to deliver government services to the ordinary people through communication networks. It implies that people experience a sense of connectedness which means they develop some sense of belonging, sharing, and feeling touched.

- Almost 487 Community Information Centers were established to create IT awareness among people in North-East India, including Assam, by the Ministry of Communications and Information Technology Department of India in 2002.
- Studies have shown that introducing ICTs has created a new form of inequality named the 'digital divide.' Earlier notions of this concept were introduced, focusing only on computer ownership and internet connection haves and have nots. Nevertheless, later studies argued that the digital divide is a distinction between the haves and have nots, but it is a division based on access to information technology. ICT does not exist as an external variable to be injected to bring about specific results. Instead, it is woven into social systems and processes in a complex manner.
- Following the trend of Modernization Theory, for the broader development of the nation, India adopted science and technology as a part of the development process that is influenced by long political choices, cultural attitudes, and the nation's post-colonial history. The social and political culture that existed in pre-independent India is also equally important to know how these cultures shaped future decisions and policymakers, the politics, and resultant technology policies.
- Although modern science and technology in India are a product of colonialism, they also had a rich tradition of science in mathematics, astronomy, medicine, and metallurgy. India experienced a period of stagnation immediately after the Industrial Revolution. The early Indian initiatives in modern science arose, almost inevitably, in Bengal, particularly Kolkata, which is often described as inspired by a combination of western liberal ideas and traditional Indian values. The development of modern science in India took a new shape after World War II, and scientific research became organized. Taking advantage of the new political environment of the world, political

elites reshaped the national identity by using science and technology, and this process of nation-building is seen as a result of the cold war.

- Modern science and technology during colonial Government were used in the interest of the colonial Government. After independence, the academicians, political elites, and scientific elites saw science and technology as a significant element of Nation Building. Throughout modern India's history, technocrats have played a central-some, even an outsized role in nation-building, whether Mokshagundam Visvesvaraya, PC Mahalanobis, Vikram Sarabhai, Sam Pitroda, or Nandan Nilekani. Madan Mohan Malaviya, too believed India's future lay in technological and industrial growth.
- Although different countries adopted science and technology after World War II to develop their nations, it is not effortless to homogenize post-colonial diversity among different countries as they are seen influenced by their indignity, and the development of science and technology is not an independent process. Rather a particular society's socioeconomic, political structure, and needs play a significant role while shaping science and technology.
- In the literature, three phases of science and technology development are found- The period from 1947s to the mid or late 1960s, the period from the 1970s to 1991, the third period from 1991 to the present. The shaping of IT takes different forms in every phase. Scholars associated with this innovation say that the origin of the innovation is 'idiosyncratic' in nature. They look at India's IT success in the context of outsourcing, offshore software development, and governmental policies.
- The story of computers in India is closely linked with the development of modern science in India. The initiation of computer technology development and manufacturing in mid-twentieth century India was essentially a sub-theme of colonial

rule in 1947. The links- personal and institutional between Prime Minister Nehru and top scientists were essential in setting India on a path to scientific development and in seeding the Information Technology revolution.

- The National Planning Committee was also an alliance between the political elite and the scientific elite. Although the alliance between scientific and political elites could make possible the science and technological development in India, their ideologies and interests influenced these personalities and activities.
- Most countries have been heavily involved with the evolution of computers and other IT firms. The Department of Defense and Japan's Ministry of International Trade Industry (MITI) have been prominent users of information technology, supported research and development, and regulated and provided incentives for the private sector. In order to encourage domestic production and the use of IT, several developing and industrializing countries have adopted government policies.
- Although some prominent educational institutes influenced science and technology development and its institutionalization in India before Independence, the period after the 1950s witnessed the growing role of institutional structure expanded enormously due to the National Education Movement. Institutes such as the Indian Statistical Institute, Indian Institute of Science, and Indian Institute of Fundamental Research started to use computers for the scientific program. Following the pattern of MITs, Jawaharlal Nehru's declaration of India as non-alignment made an unobstructed path for India to get assistance from the Soviet Union, West Germany, and Great Britain to establish higher technical institutes like IITs in India introduced computer programs and installation of computers.

- The role of government policy in the Diffusion of IT in India can be understood in the context of broader environmental factors. It talks about different phases such as political-bureaucratic culture, industry-market, academic policy culture, and civic policy culture. There are also three phases of IT policy development in India while discussing the state's protection and promotional intervention-the rigid policy restrictions (prior to 1984), eased restrictions (1984-90), and the proactive promotion of the IT Industry (post-1990). Each stage experiences a different mode of policy implementation on IT development based on the political and economic environment of that particular phase.
- Along with the other initiatives of the Government to introduce this new technology, new committees were formed. In the 1962 war with China, India got to know its shortage of modern equipment; therefore, the then Prime Minister of India, Jawaharlal Nehru, appointed Bhaba to the National Defence Council to develop scientific research in the area of the Defence force. Since the 1950s, the institutional structures for pursuing scientific objectives have expanded enormously.
- Although Government made different initiatives to make India independent in terms IT sector, it was not self-sufficient for the entire nation; therefore, international firms such as IBM were embraced. It started its operations in India through a marketing and support office in Calcutta in 1951.
- Stakeholder theory in organization study describes the corporation among different entities. The institutional power to influence and regulate can be linked to ideologies governing supply-push and demand-pull approaches to innovation. The prospects of implementation of ICTs in the departments are closely linked with the overall development of the state and the community. State intervention is essential mainly

because of financial support. The state's role in developing technology starts with implementing policy to achieve desired public benefit.

- A sociological perspective on innovation concentrates on the influence of social structures on both the product and innovation process within organizations. A machine is expected to perform a function that it is designed for. Unlike other technology, ICT establishes a more open-ended relationship between the user and the machine. As the degree of the interface between the user and the machine is much higher; therefore, it is believed that ICTs are very people-friendly and can be applied as a tool in governance and social development.
- The NIC was the first organization that brought to this state the use of satellite antennas – V-set. When the pace of development was increased, the popularity of IT increased along with the increase in demand for network bandwidth, and then NIC phased out the use of V-sets.
- To make ICT more inclusive, the state government of Assam has established public facilitation centers in DC, SDO (civil), and circle offices. Six schedule districts also have their public facilitation centers.
- To include all the people from different sections or be aware of them, it is necessary to stress publicity, and the publicity process depends upon the government publicity fund. It is the Government that decides how to spend or allocate funds.
- At first, the Central Government provided 80% of the total fund, and the state government managed another 20%. Currently, states of North-East India are given more importance, and the current ratio is 90:10.
- The Department also experienced different obstacles while making IT a part of its daily activities. If there is any genuine problem, they try to modify or regenerate the

existing technological system through the business reorganization policy. If they see that they can simplify things based on the input they receive from the stakeholders or if it is observed that things can be simplified by eliminating specific steps, then these changes are welcome by the Department. Records are kept both in hardware and software moods.

- The study observed that identifying the problem is the first step of innovation in an organization. ICT application can be applied as decision support to public administration, improving services to citizens, and empowering citizens to access. ICT serves as a democratic enhancer within the departments as it has been working to improve accountability. To make government services more transparent, accountable, and efficient, the departments where the study was conducted have been introduced ICT services between Governments (G2G), between governments and Citizens (G2C), and between governments and businesses (G2B).
- Corruption may deteriorate the quality of government performance and may be an obstacle to the proper use of public money in terms of essential goods services. That causes more poverty in the state. So, with poverty reduction and human development, ICTs have been introduced to address citizens' expectations. ICT facilitates electronic means of processing, transmission, and displaying information and faster and cheaper communication. The aim is also to boost efficiency and productivity, reduce transformation costs, and remove all barriers for everyday people to reach out Government.
- ICT has also replaced the traditional file management system that took much time while keep a record. To address the issue of 'corruption' that exists in different forms

and make everything transparent, the departments have implemented an online file management system under the umbrella project 'e- Office.

- Implementing innovation in an organization setup is also about creating change by improving something or introducing something new. To attain a particular goal of an organization requires internal innovation to some extent. The availability of technology does not mean that all are affected by it equally. The role of technology is thought to be only 15%, Business Process Reengineering is the second component that comprises 35%, Change management is the biggest problem that includes 45%, and the rest of 5% is luck, which includes leadership qualities a leader in a department. Only developing particular software cannot make a project successful. Inside the Department, it is necessary to have a champion who can initiate the new idea. After the initiation stage, 45% effort is given to change management.
- Changes are observed in the employment structure. When ICTs were introduced in the government departments, those proficient with the traditional working method could not deal with it. Therefore, People were hired from private enterprises on a contractual basis, such as EPITOME- Computer Training School, NIIT Guwahati. To work with NIC also, it was necessary to hold B. Tech / BE degree, especially in Computer Science. Again, it was observed during the study that a new post has been created within the departments called 'computer operator' who looks after the IT-related functions of the concerned Department.
- The ICT innovation and Diffusion process also includes the private-public partnership model in Assam. Even while IT policy was formulated, the CEOs of CISCO and MICROSOFT were also consulted. Their views and suggestions were taken into account. For the execution of the projects, National Project Monitoring Unit (NMU)

and State Project Monitoring Unit (SPMU) have been appointed by the central Government. SPMU, WIPRO- they guided the implementation and execution of the projects. The Government tried to follow the growth pattern and working style of the private sectors as the private sectors are more competitive and have an intelligent way of working.

- End-users in each Department were trained to make the most effective and productive use of networked and electronic information services. NIC and Administrative Staff College designed training programs to provide end-users with the necessary skills to search electronically. The training program also included workshops.
- To make maximum use of ICT innovation in the Department, it is important to blend it with the distinctiveness of the local context. Therefore, the projects are modified at the local level depending on the infrastructure facility's availability of skilled professionals. Here, it is also emphasized the use of local language while making this innovation for the common people.
- AMTRON and NIC, two foremost research organizations in Assam, perform the responsibility for conducting research relevant to the communities' technological requirements. The extension agencies perform the crucial function of collecting information on stakeholders' technological requirements, which generate the research and then prepare a package of inputs consisting of research results and support physical and financing input. Finally, the Department offers the package to the stakeholders and the community to promote inclusive development. The stakeholders may then accept or reject this package depending upon the characteristics of the innovation and the ability of the innovation to address their needs. Interaction

between these groups shapes the flow of physical resources and funds and the flow of communication.

- The process of ICT innovation and its Diffusion also require external support from NIC and AMTRON. As the process has to pass through a formal procedure, there is less scope for its reinvention or modification.
- Data on the development and growth trajectories of many developing countries reveal undue favors to specific groups, resulting in some divide. In this study, it is observed that with the cognitive elements such as age, other elements also shape the ICT innovation. Among them, social and technical elements play a crucial role in either guiding or constraining individuals while constructing meaning towards adopting ICT innovation.
- Their interests guide the reception of ICTs among the VLEs (external supporters). The high cost of technological innovation, access, and ease of adoption of technologies are considered some reasons for such non-inclusion. The economy is an essential factor while studying the shaping of innovation in society. Infrastructure is included in the budget, but sometimes the Government cannot allocate money for the project's sustainability.
- The study also aims to look at the impact of ICT on different sectors/ departments of the Government of Assam. Understanding the role of IT means understanding that these technologies are tools and agents of change under human control. Consequences are the changes that occur to an individual, organization, or social system due to the adoption or rejection of an innovation. Both adoption and rejection of a particular innovation lead to consequences on the individual and social system. Rogers (2003)

introduced three dimensions of consequences in 2003- Desirable vs. undesirable; Direct vs. Indirect; Anticipated vs. Unanticipated.

- Respondents of the concerned departments informed us that ICT has reduced or replaced human labor in intra and inter- Organizational activities. ICTs are also exercised for reporting, supervision, monitoring, and controlling the Department's activities. ICTs have also brought changes to provide services, i.e., ICT-based communication with actors outside the organization. ICTs have also brought changes towards knowledge management, helping an organization identify, collect, manage, distribute data and enable adoption. Using ICTs, the departments collect data on available resources, GIS systems, climate change, and pollution. ICTs have helped to establish interaction and collaboration both externally and internally.
- In this study, it was observed that the digital divide as a new form of inequality came out due to ICT innovation and Diffusion. There is not any single cause for this differentiation. Nevertheless, this division has different grounds. This can be viewed as an undesirable consequence of ICT adoption in the Department.
- Direct consequences alter an individual or a social system that immediately responds to innovation. Changes have been observed in the employment structure. When ICTs were introduced in the government departments, those proficient with the traditional working method could not deal with it. Therefore, People were hired from private enterprises on a contractual basis, such as EPITOME- Computer Training School, NIIT Guwahati. To work with NIC also, it was necessary to hold B. Tech / BE degree, especially in Computer Science
- On the other hand, it has also affected the significant changes in social and political systems in many countries in the recent past. Also, many other product and process

technologies have negatively affected the skill, livelihood, and social norms in specific norms. Social innovation from the sociological perspective has been investigated concerning its significance in changing social practices and structures and leading to social evolution and social change.

- As the adoption rate is not equal for each individual, the departments have created a new post named computer operators who technically support the individuals within the group while performing the ICT-related activities. Before implementing ICTs in the departments, a post called a typewriter was called. Later this type of writer's post is amended as a computer operator. When highly skilled professionals are hired or recruited for the proper implementation of ICTs (for better transparency and efficiency), the existing office personnel have always feared losing their jobs.

5.2 Conclusion

From an optimistic point of view, the emergence of Information and Communication technologies has brought changes in social, political, legal, economic, and other domains of human life. Therefore, it is essential to look at its social and financial inclusion capacity. Different individuals engaged in the technology development process interpret the meaning of a particular innovation. From a Social Construction perspective, the study looks at how social elements shape ICT innovation. It is found that ICT innovation cannot be separated from the social and political aspects in which it is applied. ICT is such an innovation that cannot be used directly by an individual without the intervention of organizations. In this study, it is found that the Departments have introduced two types of ICT applications- Intragovernmental and Inter-Governmental services. The organization has been selected for the study as organizations are seen as a platform for multiple stakeholders. In this study, it is

found that the level of flexibility welcomes different interpretations from different stakeholders.

5.3 Limitations and Further Scope of Research

The study looks at the social shaping of ICT and the interpretation of various groups engaged in the ICT development and diffusion process. Because of the limitation of time and resources, the study was conducted only in some of the departments of the Government of Assam. The study opens up the future scope of research from a gender and technology perspective in the departments. The study also opens up the future scope of research on a comparative study among different departments of the Government of Assam as the innovation diffusion process differs among various departments.



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Indian Institute of Technology Guwahati
Department of Humanities and Social Sciences

**Social Construction of Information and Communication Technologies: A Study of Selected
Departments of the Government of Assam**

Interview schedule for the officials of various organizations

Data obtained through the interview schedule will be used for research purpose only. Strict confidentiality will be maintained.

Details:

Name of the organization:

Organization size: Large/Small

Organization type: Government /semi-government/non-government

Work management: Co-ordination method/Standardization/Supervision

Distribution of task: centralized and decentralized/horizontal and vertical

Organization environment: complex/simple; stabile/volatile

1. Would you like to inform us about your esteemed organization: its establishment, total number of employees, eligibility criteria, the procedure of being promoted, etc.?
2. Has the organization introduced any Information and Communication Technology projects for the functioning of the department?
3. What are the key sectors/areas where projects are proposed? Identify some specific technology sectors/areas where technical support is required.
4. For each sector, specify whether support is required for consultation, demonstrative set-up facilities, extension and consolidation of technology, or delivery and maintenance.
5. For each project and sector, furnish a basic description, indicative cost, and agency for partnership.
6. For each project and sector, specify the nodal department and mechanism of implementing and monitoring projects.

7. If the department has adopted ICT projects, could you please give an idea of each project, the proposed outcome, indicative cost, and agency for partnership?
8. For each sector, specify whether support is required for consultation or setting up demonstrative facilities, extension or consolidation of technology, or delivery and maintenance of technology.
9. From where does the organization gather information? Is the organization engaged in any market research activity before adopting ICT for task performance? What does this organization do while deciding between technology adoption?
10. Have you noticed any changes in terms of organizational activities after introducing ICT?
11. Does the organization emphasize the factors related to the nature of the organization and the environment in which it operates while adopting and implementing ICT for daily activities?
12. Who supports a new idea? Who decides to introduce/implement or not to implement an innovation to the organization's members? Do organizational culture and structure influence the decision-making process? What are the main actions and decisions through which a new ICT project becomes an element in the organization's ongoing activities?
13. Do cost and benefits play during the decision-making process to implement ICTs in organizational activities?
14. How are individual decisions involved in introducing ICT applications in an organizational context?
15. Could you define any organizational problem that led to a new ICT innovation?
16. Does the application of ICT fit the existing structure and process within the organization? Is the department able to cope with the changes that come with ICTs?
17. If the application of ICT in this organization does not directly match the current situation, then what is the possibility of reinvention or restructuring of innovation according to the organization's needs?
18. Is there any technology project that has been completed, and how can it be demonstrated and successfully upscaled?

19. Are the use and effects of ICT visible to other members of society? If yes, how does this organization establish relationships with customers, suppliers, and employees digitally?
20. To what are people receptive to the consolidation of ICT? Is it a problem with agencies and departments, as well as with communities? What type of support might you want to solve this problem?
21. How can you see the effects of ICT on other stakeholders or users of ICT? What sectors from which consumers connect through the introduction of ICT can be improved?
22. Do you think that ICT may be a tool for social development? Will the technology projects adopted by this organization be relevant to the overall development state?
23. Is there any particular plan to include ICT for social development?
24. What priority projects or services have been identified to include ICT for the overall growth and development of the state?

