# An Exploration of Technology and its Social Impact

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# PREFACE

The book *An Exploration of Technology and its Social Impact* is composed of a collective volume of articles dealing with sociology and technology. The author believes that the contributions will lead to a wider discussion on these issues. In this respect, it is hoped that this collection of studies will be of interest to those who are inner- and inter-disciplinary involved in the areas of both social sciences and computer sciences. The contributions are of analytical and critical value to vital research issues within the context of the emerging information age. The central idea was to draw together research devoted to key questions examining the relationship between the various and widely discussed new developments of technological systems and their social impact.

The author's intention is not for this book to be a highly specialised text covering a narrow subject area. Rather, it aims to provide a view of current research within a wider scope. Unlike many texts, which are a collection of "definitive" and perhaps even "tired" works, this book contains new papers reflecting the current state of research in diverse yet related fields of study.

The author has decided against producing a highly specialised text because that would have a very limited appeal, and his wish is to bring together several complementary subject areas. Much of today's research and many of the university courses offered are interdisciplinary, and the author wished to reflect this through this book. The very nature of research is such that the availability of more perspectives can build on findings from a wide spectrum of related interests.

Major social and technological changes are currently reshaping everyday life all over Europe. Just as there are differences between regions, there are also various concepts of how to study and understand what is usually called the importance of technological progress. Recent developments, particularly in the political and economic systems in the global society, propel new ideas and increase the demand for studying the interaction between social and technological processes.

In this book, the collection of chapters presented aims to explore the following topics and perspectives: social and cultural factors relating to technical progress; the role and prospects of social research; developments concerning specific professions linked to technological changes; technological standards compared to social structures; cultural identities and economic performance; female and male perceptions of technology; labour relations and developments in the labour market; social limits to technological progress; the social impact of theoretical conceptions and sociological paradigms; further analysis of structures and trends in technological and global societies; innovative strategies in technology transfer and research; politics and European integration; and European cohesion and social and political change.

The social foundation of technology is a newly established interest area of sociology and contributions have only recently been made. Increasing interest and research in information technology—and its euphoric assumptions—are creating a wide spectrum of societal criticism. Computer-supported work, for instance, has led to the development of innovative organisational processes based on technological developments and new communication paradigms.

With the increasing economic, political, and social integration in Europe, the EU member states are also confronted with a fundamental change in labour and industrial relations. European work councils are one example of a new form of industrial relations. Since the Hofstede studies, the question remains: how far will integration go in guarding cultural specificity and identities? Is there a common European legacy to be defended? Though this situation is well known and, fortunately, there has been a large increase in university courses and training centres on this subject, there is no book which presents the issue from a European rather than just a national perspective.

The book is primarily addressed to lecturers and students in sociology, business administration, economics, law, organisational psychology, political science, and computer sciences at the university level. It is also conceived for intensive courses and seminars taught by training centres of chambers of commerce and industry, employer associations, and trade unions, or naturally for self-study.

# CHAPTER ONE

# TECHNOLOGY THROUGH SOCIAL PROCESSES

SAVVAS A. KATSIKIDES

## Abstract

In the first edition of Benjamin Kidd's *Principles of Western Civilisation: A Sociological Study* (1902), various ideas and theories were strongly criticised, and it conveyed to the interested reader ideas and assumptions about the evolution of society. Kidd tried to present a civilisation as a developing system of life, possessing a characteristic meaning of its own in the evolutionary process, and having an organic unity far deeper than of any of the nations or political states in it (1902, vii). According to this concept, the individual is only to be understood through the meaning of social processes. It is in the social process alone that we have the meaning of the human and of the laws that govern its development. Kidd had the concept of social evolution in mind, which he had published on years before, indicating that:

> It is one of the commonest sayings of the time that the distinctive feature in which human evolution differs from all previous evolution is that the human mind is itself consciously constructing the social process. This is the most pregnant idea in Western thought at the present time, and it is with preliminary aspects of it that recent developments like Pragmatism are beginning to be occupied. (Kidd 1902, vii)

He refers to Darwin and the early Darwinians, pointing out that they made no systematic study of society in any organic sense and were occupied, even when they considered species, mainly with the struggle for existence between individuals, with the resulting conflict between individual interests, and therefore with the resulting evolution of individual types of life (Kidd 1902, ix).

## Introduction

This chapter discusses a general view of sociological work, drawing on recent approaches to technology and social processes. It reviews different arguments about the sociology of technology and examines the path to social change. Social change is determined by several social processes grounded in external economic and political factors. Social change may be driven by cultural, religious, economic, scientific, or technological forces, to which we can add language, geographical area, and status of education. Societies create a knowledge grounded in history, constitutional order, and the checks and balances system. After reviewing classical and contemporary theories, which define the impact of technological processes, this paper explores the effects of sociological theory on technology and reviews Kuhn's suggestion that technology derives from different societal traditions, and accumulates and reflects social processes and cultures. According to Kuhn, society is a "panorama" society,[1] indicating global business networks, NGOs, diasporas, global cities, trans-boundary public spheres, and the new cosmopolitanism, which dominates first the political arena and demonstrates its quasi-liberalism by using this as a platform for technological domination. Some argue that these views could build the basis of an analysis of societal and policy conflicts. Further in his analysis, Kuhn asks about the invisibility of revolutions and "how the scientific revolutions close," giving a simple explanation based on the source of authority: "I have in mind principally textbooks of science together with both the popularizations and the philosophical works modelled on them" (Kuhn 1962, 136).

Two examples of different perspectives of the social shaping of technology are demonstrated; the macro-level and the micro-level. At the macro-level, the perspective developed is based on a dynamic view of the social shaping of technology. According to Salzman (1994), the main argument here is that technology is socially shaped and is part of a larger network of things and people. Using the framework sometimes referred to as a social construction of technology perspective, and building on the traditional studies of science, technology, and society, several studies have examined how technological decisions are shaped by non-technical factors. Undoubtedly, research within the emerging field of the social shaping of technology varies dramatically in the approaches used, especially in defining the range of social factors considered as relevant. On the micro-

[1] This is the author's own term.

level, the focus is on the usage of technology, which is based on the user's perceptions.

Two main factors are key issues for the problems relating to sociology: the individual and the group. Social groups are teams of individuals who interact and form social relationships. In this case, an important goal for sociology is to understand these larger social collectives and groups, an effort which is still to appear in sociology.

While examining the impact and history of technology, C. W. Mills (1956) argues against empiricism remaining in a clear theoretical position, and H. Marcuse (1994) revitalises and elaborates Weber's perception of developing the Western world by labelling human beings in modern society as a "one-dimensional man." He identifies that the process of rationalisation in modern society leads to a more or less systematic elimination of all alternatives. From another point of view, which focuses more on the theory of technological evolution and is based mainly on economic history and anthropology, G. Basalla, in his book *The Evolutions of Technology* (1988), presents "an evolutionary theory of technological change based on recent scholarship in the history of technology and on relevant material drawn from economic history and anthropology." He challenges the popular notion that technological advances arise from the efforts of a few heroic individuals who produce a series of revolutionary inventions that owe little or nothing to the technological past. Therefore, the book's argument is shaped by analogies drawn selectively from the theory of organic evolution, and not from the theory and practice of political revolution.

Three themes appear, with variations, throughout the study: *diversity*: acknowledgment of the vast numbers of different kinds of made things[2]; *necessity*: the mistaken belief that humans are driven to invent new artefacts in order to meet basic biological needs such as food, shelter, and defence; and *technological evolution*: an organic analogy that explains both the emergence of the novel artefacts and their subsequent selection by society for incorporation into its material life without invoking either biological necessity or technological process. Basalla conversely recognises the larger changes often associated with inventors as well as smaller changes made over a long duration. His theory is rooted in four broad concepts: diversity, continuity, novelty, and selection. *Diversity* can be explained as the result of technological evolution because artefacts'

[2] Referring to "artefacts," which have been available to humanity for a long time.

*continuity* exists; *novelty* is an integral part of the constructed world, and a *selection* process operates to choose artefacts for replication and addition to the stock of made things. The argument here is very much related to the first traditional separation between sociology and technology. It seems attractive to split the world into "material" and "social." More precisely, perhaps the nature and relationship between technology and society are divided in the classical approach to technological and social determinism.

## 1.1 Social Change

Although social change (Abercrombie 1994, 190) is one of the major concerns of sociology, the question of *how*, *why*, and in *what* specific ways societies are changing remains one of the most intriguing and difficult problems in the discipline. While answering the question of how we can define social change, Robertson (1989, 425) argues that it is important to understand the alteration in patterns of culture, social structure, and social behaviour. However, additional complications derive from the role of technology, which has gained great importance and has been put into a key position when it is used to explain technological determinism and its meaning in social change (Smith and L. Marx 1994, 85; Fuller 1997). For this reason, in this section the aim is to shed light on a definition of social change based on the development of new technologies. As Buchanan (1994) stated, this process of social change is linked to innovations in sources of power and manufacturing techniques, and changes in the way which people communicate in modern societies.

To begin with, it is possible to identify three waves of technological innovation that created a systematic social change in many modern societies. Based on Alvin Toffler's (1980) argument, the first was the Agricultural Revolution, the second the Industrial Revolution, and the third the Information Revolution. The second and third waves are more recent and have led many theorists to believe that information and communication tools and technologies are able to move the social world forward. This means that technology is able to promote success and bring changes to all spheres of a society. It has to be acknowledged that although many academic analysts and theorists of social change from the 1980s onwards tried to introduce the its meaning by combining it with technological inventions happening in real time, critics of their arguments were and still are inevitable. Pessimistic views are based on the idea that technology cannot be seen as a major social dynamic nor a process of change.

Furthermore, among those thinkers who tried to understand the meaning of social change, highlighting that a new sort of society is emerging due to the expansion of information, communication tools, and technology, is Daniel Bell, who undoubtedly wrote a lot on this subject between 1973 and 1999. In *The Coming of Post-Industrial Society* (1973; 1999), Bell's main point is that in order to understand the effects and opportunities in the new information age it is important to first understand the age of post-industrialism. Specifically, Bell stated that people have entered a new system, a post-industrial society, which is characterised by the presence of information (1979; 1999).

Taking into consideration all of the above, theories of the information society have distinguished two basic types of thinker. Firstly, there are those whose aim is to understand the meaning of social change, and specifically systematic change, by evoking the concept of information society. Secondly are those who believe that the past may provide answers so as to understand what changes are happening in the present and what may appear in the future. According to Castell's statement (2000, 693), the information age announces changes in society and introduces a new society thanks to the development of networks enabled by different types of information and communication technologies. Castells believes that this transformation is not just a matter of globalisation; rather, changes occur due to the expansion and growth of networks, changes in work practices, and employment patterns. For this exact reason, people must get used to being flexible in what they do and what they expect to be doing in the future, since technology—and specifically the network society—is changing continuously. Besides Castells' contemporary social thinking approach about network society, Alain Touraine's (1977) writings on social change have also proven to be very important for understanding the conceptual framework linked to the analysis of social change and collective action in the modern age. Touraine's theory of social change has emphasised the shift from the industrial to the programmed society.[3] According to Touraine, "the programmed society is characterized by the struggle no longer being over goods but rather over information. Hence, the central social struggle has moved from the sphere of production to the cultural arena" (Brinker and Gundelach, 2005, 366). Furthermore, Touraine's main contribution to contemporary sociology is based on the fact that he explained the term of social change while emphasising those different social movements, events, and tensions that occurred at intervals

[3] The term about programmed society is directly connected to the characteristics of post-industrial society.

with the aim of bringing beneficent changes in society. These tensions and events in society have been developed in the era of industrial society in which rationalisation and subjectivity are linked together. In this case, according to Touraine's writings, when rationalisation and subjectivity split and become autonomous, modernity leads to its disintegration (Hamanishi 2014). At this point we may get a better idea of how modernity is linked to social change if we investigate Ulrich Beck's theory of "reflexive modernization" (1992). To simplify, reflexive modernisation refers to "the modernization of modern society" (Beck, Bonss, and Lau 2003). In other words, reflexive modernization represents the transformation of modern societies within modernity. By this, Beck emphasises all the changes of societal structures that the second modernity absorbed from the first. These changes happening in society affect the entire construction and as a result new kinds of society, state, global order, norms, rules, and everyday life are being produced. Along with these changes, the new modernity gives rise to a risk society, which more or less makes science and technology responsible for it. In this case, in Beck's *Risk Society: Towards a New Modernity* (1992), it is highlighted that individuals must make their own decisions about these hazards which globally exist in Western societies.

Beyond the different arguments about the meaning of social change in modern ages, in which technology plays an important role in all the spheres of modern societies, there is a general agreement that modernity and the development of information and communication tools have made dramatic changes to the social structure. This argument indicates that the theories of modernisation belong in the same category as theories of social change. For this reason, in studying the theory of social change and trying to understand its definition in a sociological sense and framework, it becomes clear that this context of analysis is linked to arguments associated with post-industrialism, post-modernism, and social movement theories. Although the intention in this chapter was to restrict the analysis of "social change," a few words about the theory of social movements may help this discussion end smoothly.

Through social movement theory, we can understand how and why people aim to join together in a collective manner in order to claim their requirements, chase their goals, and resolve different issues happening in society, and the ways in which these manage to bring social change. Within this context of analysis, it is useful to clarify the character of social movements as a set of collective actions, which finally have as their goal to achieve changes in society. In *The Blackwell Companion to Social*

*Movements* (2004), the authors highlight three mechanisms of strategic change due to the expansion of social movements in society. The first is called strategic anticipation (contenders anticipate the reactions of other actors and choose the option that provides the optimal balance of costs and benefits), the second refers to adaptation (contenders are connected through mobilisation processes), and the third concerns the environment selection, which is needed due to the fact that a free circulation of information in some polities is prevented (Snow et al. 2004, 30–1). Social movements as vehicles of social change were also argued by the so-called Chicago School led by Robert E Park, Herbert Blumer, Ralph Turner, and Ernest W Burgess (Porta 1999). Another contribution to the definition of social change based on social movement theory in the programmed society was made by Alberto Melucci between the years 1985 and 1995. Melucci described modern societies as highly differentiated systems which invest in the creation of autonomous centres of action. Finally, it could be said that society is not a steady process but a continuous and unending stream of movements and events (Sztompka 1994).

Taking all of the above into consideration, social change theory owes many of its insights to the theorists who tried to explain changes happening in the social structure by stressing the meaning and importance of collective actions along with the meaningful acts of social movements. Therefore, the search for a system based on theory is still incomplete and much sociological work in our field is a synthesis of scientifically guided endeavour on society and nothing more.

## 1.2 A Theoretical Approach to Social Class

In the 1990s, the class issue became an outdated interpretation and broke from the consisting tradition of sociological work. As Clark and Lipset stated:

> Social class was the key theme of past stratification work, yet class is an increasingly outmoded concept. Some reasons for this devaluation were the increasing importance of other themes and issues, such as the starting discussions on global societies and their impact, or technology and society, and the formulation of a simple question like *who drives whom*? (1991, 397)

Specifically, in Max Weber's *The Theory of Social and Economic Organization* (1947) there is an extensive analysis of the notion of class, and Weber's definition will help us move further with our analysis. Weber

(1964, 424–5) defined a class as any group of persons occupying the same class status. These types of classes may be distinguished as: (a) a property class when class status for its members is primarily determined by the differentiation of property holdings; (b) an acquisition class when the class situation of its members is primarily determined by their opportunity for the exploitation of services on the market; (c) the social class structure is composed of the plurality of class statuses between which an interchange of individuals, personally or in generations, is readily possible and typically observable. On the basis of any of the above three class status definitions, associative relationships between those sharing the same class interests, namely corporate class organisations, can be developed. However, the concepts of class and class status only designate identity or similarity in the typical situation, in which an individual and many others find their interests defined. In principle, control over different combinations of consumer goods, means of production, investments, capital funds, or marketable abilities constitutes class statuses which are different with each variation and combination.

Anthony Giddens' (1973) new theory and definition of social class have also played an important role in social sciences. Giddens' aim was to add new knowledge to the context of sociological theories which were based on social class arguments. He added a new analysis which stated that social structures are dependent on rules and resources and underlined that social life, which is based on human activities, is formed and shaped by this structure. From Giddens' assumptions about social classes and the structure of society, it is clear that he rejects materialism and believes that political influences are the main reason for forming society and developing class structures.

Furthermore, Bourdieu states that "a class is defined as much by its being-perceived as by its being" (Bourdieu 1984, 483). In particular, Bourdieu provides a theory that incorporates the material aspects of social class in the conceptual form of fields and practices. Bourdieu's theoretical model of society revolves around four concepts: (1) "fields," or aspects of social life that generate complex networks of rules and relations, and support specific practices necessary to maintain themselves; (2) "habitus," or the system of dispositions to action produced out of past conditioning and the structuring of one's actions towards stimuli in the field; (3) "practice," or actions that manifest through the mechanism of habitus in order to navigate the field; and (4) "capital," or various resources the individual attempts to acquire, convert, and use in practice (Ritzer 2008, 329).

Moreover, Bourdieu aims to reject the identification of social classes according to “discrete groups” or “simple countable populations separated by boundaries” (Bourdieu 1984, 483). He instead prefers to refer to social class based on the “practical knowledge” of agent-subjects and refers to the social world while emphasising “the division of the work of domination” (ibid., 466).

## 1.3 Social Theory around Technology

As Anthony Giddens (1986) indicates, “social theory” is not a term with any precision, but it is very useful. From Giddens’ point of view, social theory involves the analysis of issues which can be connected to philosophy, but it is not primarily a philosophical endeavour. The social sciences are lost if they are not directly related to philosophical problems by those who practise them. Social theory has provided perspectives of human social activity and the human agent, which can be placed in the service of empirical work. The main concern of social theory is the same as that of the social sciences: the illumination of concrete processes of social life. As has been pointed out in previous works (Katsikides 1998a), an effort must be made to understand societal transitions and methodological means, or, as Talcott Parsons advocates, in using sociology to study the relationship of an individual’s experience in society and history, the starting point for the sociology of technology must be through science.

Holmwood, in an article dealing with feminism and epistemology (1995), outlines the argument that the challenge for social theory is to reconstruct its explanatory categories rather than deconstruct the explanatory undertaking. Postmodern theory is a capitulation in the face of our problems rather than any solution to them, and according to many theorists postmodernism embeds contradiction in its theory of knowledge. Specifically, Salzmann and Rosenthal (1994) focus on the design of workplace technology and show how software design and usage lead to essential tasks of engineering involving social values. These social values reflect the economic and political structures of organisations, and provide the background assumptions shaping people’s perspectives of their world of work. Social critics also addressed this issue at an early stage, such as Lewis Mumford (1934) who saw it as a problem of technological society and autonomous technology. Moreover, Jacques Ellul (1964) has warned against the technological dominance of human life and the ensuing impoverishment of the human spirit. From a critical point of view, we can mention David Noble (1984), who observes that "although it has belatedly become

fashionable among social analysts to acknowledge that technology is socially determined, there is very little concrete historical analysis that describes precisely how." Noble's pioneering work has developed a growing interest in a body of research regarding the social shaping of workplace technology. Other useful works in this direction are Bijker, Hughes, and Pinch (1987), Corbett, Rasmussen, and Rauner (1991), and Rammert (1992).

Generally, sociological theories should fulfil various functions. As Glaser and Strauss (1967, 3) mentioned:

> the interrelated jobs of theory in sociology are: (1) to enable prediction and explanation of behaviour; (2) to be useful in theoretical advancement in sociology; (3) to be usable in practical applications, with explanations being able to give the practitioner understanding and some control of situations; (4) to provide a perspective on behaviour; and (5) to guide and provide a style for research on particular areas of behaviour. This theory in sociology is a strategy for handling data in research and providing modes of conceptualisation for describing and explaining.

Adorno (1972, 83) wrote that "the application of theory remained uninfluenced by the examining practice. Theory and empiricism cannot enter the same continuum." According to the empiricism of technological development processes (Hochgerner, 1986, 11), it was usual in sociology to take technical equipment and facts into account almost exclusively as external societal factors. Few exceptions existed outside the dominant development lines of the discipline. The systematic consideration of technical aspects within social norms, the observation of technology as a societal endogenously produced element, implies a transformation of the structures and modes of operation of social relations on a long-term basis. Bearing these points in mind, the question here is: should the issue, the tasks, the theoretical and methodological points of sociology be extended and partly revived on this foundation? In addition, what happens with complex positions to which a medium range theory cannot offer satisfactory solutions? (Merton 1968). A synthetic theory is required which can neither be postulated in a systemic theoretical form nor be gained through the state of societies theory. For this exact reason, the general voice for a system theory has become stronger than ever (Bertalanffy 1978; Miller 1978).

## 1.4 Empirical Studies on Technology and Labour

Until the end of the 1970s, traditional thinking in industrial relations focused more on the sociology of work and carried out remarkable studies

which analysed the relationship between employment and the institutions associated with it. At the core of this argument, these analyses managed to explain the relations between workers, work groups, and worker organisations and managers, companies, and employer organisations. Undoubtedly, the study of industrial relations is an interdisciplinary enterprise, drawing heavily on industrial sociology, labour economics, trade union history, and, to a lesser extent, psychology and political science (Abercrombie 1994, 213).

Moving forward to analyse the position and values of technical workers, several ideas and notions can be made. Crawford (1989) has pointed out that only two empirical studies compare the position and values of technical workers in old and new industries. Crawford introduces a study of French technical workers, publishing the findings of an investigation into the work, careers, and ideologies of French engineers and managers employed in two industrial settings; a traditional metal working firm and an advanced telecommunications firm. What makes this notion so interesting is the passage from theoretical considerations to real life on technological systems. Whether technology drives society or vice versa seems to have reached a dead end; a new discussion is required which includes ideas on social media and changes in associated behaviour, and their impact on social processes. The social accessibility of technological tools is a pre-requisite for new social groups to form and has to undergo both adoption and familiarisation by actors in these groups.

Several empirical studies,[4] as Crawford (1989) stated, have tried to describe the largely unsuccessful struggles of American mechanical, electrical, and other engineers to develop codes of ethics and unity, and form an association powerful enough to represent the interests of employers and the state. It must be highlighted that other aspects of the advanced society and its industrial system are constructing the main protagonists. In trade unions, for instance, education and training, collective agreements, and market performance play a vital role in technological decisions. Contemporary status and the identity of engineers were the aims in Calhoun's work in *The American Civil Engineer* (1960) or Layton in *The Revolt of Engineers* (1971), as well as Noble in his pioneering *America by Design* (1977). Further studies in France, such as Grelon's work on the history of French engineers in "La Modele de l école d ingénieurs comme formation: la technologie et comme insertion dans la société" (1987), have

[4] See, Zussman (1985), who managed to evaluate the meaning of position and values, and Whalley's (1986) volume on British engineers.

provided an analysis of the historical structures of the time. The outcomes of all these works were considered as pioneering, as the emerging ideas highlighted that if we cannot change the industry or the capital behind it then we must change the engineers instead. This concept, however, finally failed.

Furthermore, Salzman (1994) stated that the main view of engineering is that it is an "applied science"; it is the application of scientifically and objectively determined principles. The "scientific view" of technology is based on the fact that advances in knowledge are largely independent of subjective influences. Technology reflects engineers' calculations of the most economic and efficient designs to utilise that knowledge. This is the dominant view of engineering as expressed by the US Board for Engineering and Technology, as "the profession in which a knowledge of the mathematical and natural sciences gained by study, experience, and practice is applied with judgment to develop ways to utilize, economically, the materials and forces of nature for the benefit of mankind." Where social choices or values are considered, they are important for decisions about the use or development of technology, but not as an integral part of the design process. All of the above constitute the formation of technology within the social context.

Furthermore, the example of introducing matchlocks in Japan (Perrin 1989) has clearly shown the distinction between the social change and the technological push, because technological change handles the rapid changes in work and in society.[5] From the time of the first industrial

[5] The Europeans brought with them two matchlock muzzle-loading hand guns. The introduction of these novelties to a traditional complex system of values within the Japanese society created such turmoil that the Japanese decided to abandon them until 1855. Basalla, in *The Evolution of Technology*, argues that the process to adopt weapons in Japan had found a place immediately. "The Japanese were so impressed by these primitive firearms that they purchased them on the spot and set their swordsmiths to work duplicating them. Within a decade, gunsmiths all over Japan were turning out firearms in quantity. The warring feudal factions in Japan, eager to obtain weapons superior to their swords and spears, encouraged these developments." Noel Perrin (1978, 78) gives a totally different view of this historical event. After a time of liberalisation of the production of guns, the government's monopoly was stabilised by1625 and the central government decreased the orders for weapon production. In 1673, for example, only 53 big and 334 small matchlocks were manufactured. To maintain the traditional life and power in the Japanese society, the government abolished the use of guns and after 1637, for the next two hundred years, no wars were carried out with guns in Japan.

revolution until the third microelectronic revolution, which we are experiencing today, only a few sociological works have attempted to explain the phenomenon of technology in its social construction. At the same time, social surveys were conducted by Charles Booth (1840–1917) using a combination of early survey techniques and other less statistical methods. In the twentieth century, the Chicago School and various anthropologists studied the way of life by living among them and viewing these societies from the inside (participant observation). Following the Second World War, Paul Lazarsfeld (1901–1970) gave greater emphasis to the importance of data being objective. The review of various other methods, ideas, and models was considered. Within this context of analysis, McNeill (1990) argued that when testing the ideas in the real world, the choice of research methods is often decisively affected by choice of topic, and the amount of time, money, and work hours available.

## 1.5 The Conceptualisation of Innovation

A further step was the theoretical approach to political technology and designer technology, which ended with actor networks and contingent technology. Elster (1983) stated two main approaches on this point; first, that technical change may be conceived as a rational goal-directed activity and as the choice for the best innovation among a set of feasible changes. Second, technical change may be the cumulative addition of small and largely random[6] modifications of the production process. Freeman (1987) has contributed to this argument by proposing a third approach to technical change. While recognising that both of the previous two approaches have a domain of validity, he agrees that they arise from rational choice and changes in production. He further argues that new combinations of radical innovations related to both major advances in science and technology and organisational innovations could be the third dimension to the approach discussed above. He continues by saying that:

> Such new technological systems can offer such great technical and economic advantages in a wide range of industries and services that their

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The history of Japan demonstrates the fact that technological progress in the seventeenth to nineteenth centuries was developed in another mode than the West. Japan has undertaken a selective steering of technology and has developed other techniques and technologies in different fields.

[6] Statisticians usually use the terms “random” and “stochastic” as synonyms. However, stochastic originates from a Greek term that means aiming an arrow. It has a dynamic directionality lacking in randomness.

> adoption becomes a necessity in any economy exposed to competitive economic, social, political, and military pressures. Increasingly this century, the worldwide diffusion of such new techno-economic paradigms dominates the process of technical change for several decades and powerfully influences economic and social developments, even though it does not uniquely determine them. Although the accumulative pre-requisites of innovation should influence the technical change, they say nothing on existing concepts as demand pull or technology push ideas concerning paradigmatic thoughts on technological descriptions.

These views, however, have been split into two large categories; first, the theory of the autonomous development of technology (demand pull) and those who claim that it is the market and other economic and social influences which primarily determine the scale, the rate, the direction, and sometimes even science itself (Freeman, 1987). On the other hand, Schmookler, in *Inventions and Economic Growth* (1966), demonstrates with statistics and figures on patent inventions that the invention activity lagged behind the peaks and troughs of investment activity. Based on this connection, Schmookler wrote in his influential work that the main stimulus to invention and innovation came from the changing pattern of demand, measured by investments in new capital goods. Within this point of view, he outlined the external events as the main argument, rather than the invention push, which handles the consistency of investments and plays the major role in the demand-pull theory. Later on, Mowery and Rosenberg (1979) in "The Influence of Market Demand upon Innovation," stated that human needs are almost infinite and often long felt, and cannot explain the emergence of the particular invention at a certain time. Also, they criticise the underlying confusion in various studies in the 1960s and 1970s which attempted to show market demand as the driving force of innovation. Finally, all this led Mowery and Rosenberg to the belief that innovation results from the interaction between science and technology push factors.

## Conclusion

What has been said about the social and technological impact could link the ideas discussed and their association to the distinctive schools of thought, and shows a new analytical perspective in the sociology of technology and information. Yet, the final word remains to be seen; the creation of the digital world and its impact on social processes invented cyberspace as the extension of the real old world. The result of this is that

traditional societies are losing this space in the existing structures of their society. Sassen (2002, 382) points out that:

> Cyberspace is, perhaps ironically, a far more concrete space for social struggles than that of the national political system. It becomes a place where non-formal political actors can be part of the political scene in a way that is much more difficult in national institutional channels. National politics needs to run through existing formal systems, whether the electoral political system or the judiciary (taking state agencies to court). Non-formal political actors are rendered invisible in the space of national politics.

The context of the virtual political system varies substantially across representative democracies, both new and old. As we have seen in countries such as the United States, Australia, and Sweden, multiple parties are now on the web with hundreds of interest groups, social movements, and news media, and thousands of LISTSERVs, chat rooms, and discussion groups flourish. According to Norris in *Digital Divide* (2001, 220), if the political system varies then we are standing in front of a new communication environment, and the internet galaxy, as Castells (2002) argued, is the new gate to it.

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