HISTORY OF FORESIGHT TECHNIQUES FOR CREATIVITY AND INNOVATION

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Summary

This chapter discusses the history of foresight with a specific focus on the manner in which foresight techniques and methodologies are related to (and give rise to) creativity and innovation. Foresight is an old practice and a more recently developed science. It involves both linear (analytical or logical) and non-linear (creative, lateral, fuzzy logic, chaos theory) ways of thinking about the future in an attempt to design possible scenarios or visions to strategically plan for action towards a desirable future or to mitigate unpleasant circumstances. As a practice, foresight is based on a number of theoretical underpinnings and on what are generally considered to be 'foresight cycles', or stages in the development of foresight techniques, which build on previous experience.

Following a review of some definitions of foresight from which epistemological issues emerge, the knowledge claims of this relatively new discipline are explored. This gives rise to the question, 'why foresight?' The rationale of foresight practice will be debated, drawing on claims for its relevance concerning the predictive power of social, economical and technological planning. The role of foresight in innovation policy and its relationship to national systems of innovation is then addressed. The chapter concludes with reflection on the future challenges which this fledgling discipline is expected to face in the future.

1. Introduction

> It is not the strongest of the species who survive, nor the most intelligent; rather it is those most responsive to change. (Charles Darwin)

As the arrow of time progresses, change occurs exponentially. Looking back at the past fifty years or so it is possible to identify a number of significant social (e.g. civil partnerships, decreased birth rates, recent demographic shifts towards a more elderly population), economic (e.g. new revenue models, network dynamics and effects) and technological (e.g. e-government, instant and constant connectivity, nanotechnology, biotechnology) changes.

Is it possible to look ahead to identify future visions or possible scenarios? Would it be possible to design a strategy to steer a path towards a desirable future? How would this affect the manner in which the social, economic and technological spheres evolve? How relevant is this in times of upheaval and constant change? What links and interrelationships emerge between the concepts of foresight, creativity and innovation?

Foresight combines both linear (analytical or logical) and non-linear (creative, lateral, fuzzy logic, chaos theory) ways of thinking about the future in an effort to design possible scenarios or visions to strategically plan for action towards a desirable future or to mitigate unpleasant circumstances. As a practice, foresight is based on a number of theoretical underpinnings and on what are generally considered to be 'foresight cycles', or stages in the development of foresight techniques, which build on previous experience.

Foresight is even more crucial and relevant in times of upheaval and change since it would be considered detrimental for organizations, public institutions or strategy consultants to simply drift with the tide. The creation of a vision or of a number of possible scenarios provides a potential opportunity for those who do not wish to sway like reeds in the wind with no control on their future. Utilizing foresight methodologies allows for creative possibilities and innovative solutions. Foresight facilitates the process of designing a strategy, a journey or a roadmap towards a future which is desirable, feasible and viable.

This chapter discusses the manner in which foresight may be utilized, with particular emphasis on the relationship between foresight, creativity and innovation and the exciting dynamics which are emerging at the interface. Thinking about the future requires an element of imagination and a positive attitude towards change and all that it brings in its wake. Creativity involves the generation of ideas without censure, where thinking 'out-of-the-box' is encouraged, at times on a more radical level than others, depending on circumstances and context. Once ideas have been generated, they are generally communicated and evaluated, with only a select few making it through to the next stage and to implementation. This requires reaching out towards an uncertain future, either in the short or long term. Creative ideas feed the innovation process particularly when there is space and freedom to consider more long-term time horizons. The very existence of innovation requires creativity, that is, the prior generation, communication and evaluation of original ideas.

The success of innovation is more pronounced when the process is strategically managed. Innovation management facilitates the creation of a strategy for the implementation of creative ideas that are considered to be feasible and which add value to a product, a process or a service. Foresight may feed into the innovation process at various levels, from the top where strategic decisions on innovation policy are taken, through to the bottom of the governance pyramid where the innovation players (firms, consumers, researchers and technology brokers) create and satisfy the demand for innovation.

Foresight plays an important role from the top to the bottom of the governance pyramid, in helping to define long-term visions. Attention to the selection of key areas towards

which funding for research and innovation should be allocated is often a main focus, particularly where budgets for issues related to innovative aspects of science and technology are concerned. A number of foresight methods are available and these are applied mainly in the areas of policy making (ICT, science and technology, environment and energy), in the economic sphere (budget considerations and allocation of resources) and in private organizations (corporate foresight). The design of future scenarios draws on the imagination and on the skills of creativity as it involves the generation of novel ideas and possibilities.

An issue which deserves to be addressed is the transdisciplinary nature of foresight, creativity and innovation. All three topics have been applied to numerous issues which relate to, amongst others, the social, political, environmental, economical, technological and scientific fields.

The motivation to be open minded and to view issues in a holistic manner, paying particular attention to linkages that may not always be evident to those who are locked into one particular perspective or system, is important for both learning and success. Emphasis on the transdiplinarity of those involved with the future is key as:

> The best futures scholars strive to be transdisciplinary systems theorists. It helps to be open to learning the unique dynamics of all physical systems around us, not just to visualize within the domain we find most comfortable. 'Seeking multidisciplinary is a never ending, lifelong process of balanced inquiry, and a very rewarding journey' (Acceleration Watch).

This chapter discusses the history of foresight with a specific focus on the manner in which foresight techniques and methodologies are related to (and give rise to) creativity and innovation. Following a review of some definitions of foresight from which epistemological issues emerge, the knowledge claims of this relatively new discipline will be explored. This gives rise to the question, 'why foresight?' The rationale of foresight practice will be debated, analyzing the basic claims for its relevance in terms of the predictive power of social, economical and technological planning.

An in-depth account of the history of foresight needs to take account of the processes and mechanisms whereby foresight may give rise to creative and innovative outcomes through a consideration of foresight methodologies. The role of foresight in innovation policy and its relationship to national systems of innovation is then addressed.

The chapter concludes with reflection on the future challenges which this fledgling discipline is expected to face in the future.

2. What is Foresight?

Foresight, viewed as a practice, has often been linked to attempts to improve both policy and decision making. As Miles *et al.* (2008) claim, 'In recent years, the term 'foresight' has become widely used to describe a range of approaches to improving decision making. As the term implies, these approaches involve thinking about emerging opportunities and challenges, trends and breaks in trends, and the like' (2008: 11). It is

evident that creativity, which involves the generation of ideas and out of the box thinking, is a necessary prerequisite for the identification of emerging opportunities and challenges.

Successful foresight activities require linear, logical and analytical thinking *together with* imaginative creative (and therefore 'non-linear' and at times, apparently 'non-rational') thinking. An often quoted definition states that 'Foresight is a systematic, participatory, future intelligence gathering and medium-to-long-term vision-building process aimed at present-day decisions and mobilizing joint actions' (FOREN, 2001). Both analytical and creative thinking are implied in this definition: systematic intelligence gathering is likely to require logical methods, while medium-to-long-term vision-building requires the use of the imagination, creative thinking and may, moreover, require the use of additional tools which facilitate out of the box thinking. Foresight is a participatory process which explores possible future scenarios and which aims to be action oriented.

Martin (1995) emphasizes the 'long-term future' as he lists the areas where foresight is more likely to be applied. He defines foresight as 'the process involved in systematically attempting to look into the longer term future of science, technology, the economy, and society with the aim of identifying areas of strategic research and the emerging generic technologies likely to yield the greatest economic and social benefits' (Martin, 1995). It is interesting to note that this definition is similar to Irvine and Martin's (1984) definition of technology foresight, which is 'a process which seeks to look into the longer term future of science, technology, the economy and society with the aim of identifying the areas of strategic research and the emerging generic technologies likely to yield the greatest economic and social benefit' (Irvine and Martin, 1984).

2.1. Technology Foresight

Georghiou claims that technology foresight is 'a systematic means of assessing those scientific and technological developments which could have a strong impact on industrial competitiveness, wealth creation and quality of life' (Georghiou, 1996). In a similar vein, Constanzo views technology foresight as 'a systematic means of assessing scientific and technological developments, which could have a strong impact on industrial competitiveness, wealth creation and quality of life' (Costanzo, 2004).

Technology foresight has evolved over time, developing from a tool used to depict critical technologies, into an encompassing and often institutionalized mechanism which may be applied to identify long term trends which affect societies. Although there does not appear to be much space for creativity in the definitions provided by Georghiou and Constanzo, it is relevant to note that innovation is a key element where technology foresight is concerned. Innovation, as stated in the Introduction (See Section 1), is to be distinguished from creativity since it involves the implementation of creative ideas related either to concepts, products, processes or services, in a strategic manner, with the intention of a successful outcome. This is similar to Constanzo's implied consequence for technological foresight in the foregoing quotation, that is, 'a strong

impact on industrial competitiveness, wealth creation and quality of life', all of which are possible through a combination of both foresight and innovation practices.

2.2. Creative Disruption

Outcomes related to both foresight and to innovation may proceed either in a linear (or incremental) manner, or in a manner which totally disrupts, displaces or changes that which went before. Radical innovation and radical foresight outcomes would require a change in attitudes and in mind sets (possibly also a paradigm shift) as they involve the implementation of new products, services or processes, often involving the introduction of new technology.

The Hegelian concept of the dialectic (see Section 5.2 for further details) and Schumpeter's (1942) concept of 'creative destruction' could be applied to describe the process that comes about through radical innovation. Could foresight exercises be viewed as a new type of 'creative destruction'? Schumpeter relates this concept to capitalist market structures as he describes the term:

> The opening up of new markets, foreign or domestic, and the organizational development from the craft shop to such concerns as U.S. Steel illustrate the same process of industrial mutation — if I may use that biological term — that incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one. This process of Creative Destruction is the essential fact about capitalism (Schumpeter, 1942: 83).

Schumpeter's concept of 'creative destruction' is clearly visible in the emergence, proliferation and diffusion of new services and products which 'revolutionize' current structures and destroy old ones. New technologies, such as email, for example, disrupt previously established technologies such as fax machines and snail mail; personal computers and laptops disrupted the previous use of electronic typewriters which, in turn, had previously disrupted the use of manual typewriters. The Hegelian dialectic, which involves two opposing forces, a thesis and antithesis, later developing into a synthesis, is apparent when two technologies emerge which are in competition with each other, with a third and often improved technology emerging as a result. Some examples of this are different types of floppy disks for PCs, now replaced by memory sticks, and VHS and Beta cassettes for video machines, replaced by online download processes.

Incremental models of innovation or foresight, on the other hand, generally exploit the potential of existing forms of products, services or products, making use of existing (as opposed to radically new) technologies. Global Positioning Satellites and their widespread application for military and civilian purposes are one example of an incremental innovation process. This technology was first utilized for navigation at sea and later applied to travel over land, and the technology is now installed in numerous vehicles. On the other hand, digital technology utilized for cameras displaced (and took over) from the previous technology which utilized chemically coated film. Small hand-held e-readers appear to be displacing book publishing technology just as e-journals and e-newspapers appear to be displacing hard copies (print) journals and newspapers, with

new challenges and opportunities emerging such as on-line peer reviews and on-line forums (see Smecher, 2008).

The subsequent effects of such shifts in established ways of doing things may easily result in the dissolution of one or more organizations, or it may instigate action to explore possibilities and to move in innovative directions. The decline in business for travel agents due to increased online reservation systems has, for example, led to attempts towards increased specialization and personalized service.

2.3. Forecasting versus Foresight

The terms forecasting and foresight are often used interchangeably and certain features are shared in terms of rationale and approaches, often leading to confusion over targeted and expected outcomes. It is therefore important to clarify the extent to which applied foresight is similar to the efforts of futurists or forecasters and what if any distinctions need to be drawn.

Forecasting is generally considered to rely on quantitative tools, predictions are based on existing conditions and trends, and the focus is on incremental as opposed to long term change. Futurists, on the other hand, create alternative scenarios and they may use both (or either) qualitative and quantitative tools. As one description states, 'Since long-term predictive forecasts are rarely correct, futurists describe alternative plausible and preferable futures, in addition to the expected future' (The University of Houston, 2011).

Forecasting is often considered to be a predecessor to foresight and '[it] used to be considered as *the* approach to envisage the future. It is by definition normative and aims at predicting (technological) developments on the basis of the extrapolation of perceptible trends' (FORLEARN Guide). Although forecasting 'may involve the use of time-series data from the past to extrapolate the likely path of future trends or the possible occurrence of future events', yet, today, 'it is increasingly considered as one input in the foresight process among others, rather than a 'stand alone' method' (FOR-LEARN Guide).

Three characteristics that distinguish foresight from forecasting are, according to de Lattre-Gasquet (2009):

1. It uses a pluridisciplinary approach of systemic inspiration, based on the principle that the problems we face cannot be correctly understood if reduced to one dimension and divided into several parts.
2. It integrates the long-term dimension, past and future. It looks at past tendencies (retrospective) to better envisage the future. It considers that some variables have a relatively profound inertia (i.e. demography, ecosystems) whereas others have shorter timescales (i.e. technological innovation, foreign exchanges).
3. It integrates breakthroughs, whether technological, social (i.e. human desire to change the rules of the game), or economic (i.e. market saturation) (de Lattre-Gasquet, 2009).

The practice of foresight has developed in such a manner so as to provide tools and methods which may be applied to a number of areas, although the practice of informing policy making, particularly where decision making related to science and technology are concerned, appears to be one of the main motives for conducting foresight activities.

2.4. Corporate Foresight

The potential for foresight in the corporate context is growing and gradually being recognized, however it is still under utilized. Shell was one of the first private organizations to use foresight tools in the late 1960s (see Section 3 on the History of Foresight. Some resistance has been reported (see, for example, Graves, 2007) as foresight, in a similar manner to innovation, involves change which, in turn, may bring about an uncomfortable feeling of uncertainty and lack of security, together with the necessity to change habitual and established ways of doing things.

The manner in which foresight tools and practices are utilized by organizations is similar to road-mapping where a strategy is created in an attempt to formulate scenarios and to design a plan for action towards desirable outcomes in the future and to mitigate unwanted effects or consequences.

Particular difficulties may arise when introducing foresight practice into an organization as:

> Corporate foresight often faces difficulties in bringing its operational and strategic management on board and also positioning itself within the main stream of corporate strategic thinking. Foresight involves providing a form of intelligence that tends to be unfamiliar to operational management. Although it deals with technology and its impacts, frequently, it is not carried out by technologists. Its focus is on society's response to technology and its preferences. Because of companies' priorities and business imperatives, corporate Foresight exercises and projects tend to have short time scales. (FOR-LEARN guide)

Similar difficulties may emerge related to the introduction of both idea generating methods (creativity) and innovation management in organizations. Barriers may include aversion to change or to risk taking, resistance to changing attitudes such as lock-in or more conservative mind-sets which may not be accustomed to sharing ideas. Excessive bureaucracy and issues related to lateral and horizontal communication may also create barriers.

Corporate foresight activities may target any number of areas which including technological, social, environmental, economical, ecological or political topics, and foresight related processes or methods, such as trends (social, political, economical or technological), weak signals, horizon scanning, demographics, consumption patterns, value systems and innovative emerging market opportunities may be incorporated into such activities.

3. A History of Foresight for Creativity and Innovation

Human beings have always been fascinated with predictions of future events and curiosity about the future has spawned countless initiatives over the centuries. Most cultures in pre-history and in antiquity had some form of divination which promised to foretell the future. Some of the prehistoric temples in Malta, for example, which date back to 3,800 BC, posses what archaeologists consider to be 'oracles'. These generally consist of oval shaped holes, carved out of stone, one of which, located at the Hypogeum, an underground 'temple' and burial place, emits an eerie rebounding voice when a deep male voice speaks into it.

The Delphi Oracle is the most important oracle in the classical Greek world according to Greek mythology. This Oracle, located on a sacred temple site, is said to have predicted future events. It advised rulers and other people on their fate and on the implications of their choices. Though very successful, the Oracle probably did nothing more than modern day astrologers and fortune tellers do, simply providing sufficiently vague statements into which people could read whatever they wished. Delphi is today the name given to one of the most renowned foresight tools (see Section 6.1)

The Enlightenment, in the eighteenth century, was an optimistic time with a strong focus on rationality and science following Newton's discovery of the laws of motion. Enlightenment thinkers believed that the laws of society would be revealed to them and that they could be used to improve society. Freedom, democracy and reason were the Enlightenment values that replaced dogma, ignorance and superstition.

3.1. Science Fiction: Utopian and Dystopian Futures

The utopian futuristic hopes of the Enlightenment are evident in Louis-Sebastian Mercier's book *L'Ann 2440*, first published in 1770 (translated into English as *Memoirs of the Year Two Thousand Five Hundred*). This publication involves a thought experiment where a man falls asleep following an argument with a philosopher about the current injustices in Paris and, subsequently, finds himself in a utopian Paris in the year 2440. Religion and superstition have been totally eradicated, as have other seemingly unjust systems such as taxes, armies and slavery. Although both wealth and poverty still existed in Mercier's vision of the future, his work embodies the values and aspirations of the Enlightenment and its hope for progress through reason and science.

Numerous publications are available on utopias and dystopias. As Lynman Tower Sargent, writing in 1976, said: 'I have recently "completed" reading every utopia (utopia, dystopia, and utopian satire) published in English from 1516 to 1975 and still extant'. There are about 1500 such works.' (1976) The 'inventor' of the genre is said to be Thomas More, an English Catholic, who published *Utopia* in 1516 (originally in Latin, with a subsequent English edition published in 1551).

Another influential utopian was Edward Bellamy (1850 – 1898), an American author who, in 1888, published *Looking Backward from 2000 to 1887*, set in the year 2000. Bellamy's positive image of the future was so strong and influential that various types of clubs were set up to discuss and to implement his ideas.

Jules Verne (1828 – 1905) and H.G. Wells (1866 – 1946) are considered pioneers of the genre of science fiction. Verne's three most renowned books, *Twenty Thousand Leagues Under the Sea* (1870), *A Journey to the Center of the Earth* (1864) and *Around the World in Eighty Days* (1873) incorporated ideas related to underwater and air travel before submarines or airplanes were invented.

Verne's creative imagination and his skill for predicting the future is evident in *Paris in the 20th Century*, a dystopian fictional novel, written in 1863, but which was only published posthumously when it was re-discovered in 1994. The main character in the book, Michel Dufrénoy, lives in Paris in 1960, a city with high rise buildings, a fast train network, cars, calculators and a 'telegraphic' communications network which sounds very similar to today's internet.

Other dystopian images of the future appeared in H.G. Well's *The Time Machine (1895),* in George Orwell's *1984* (1949) and Aldous Huxley's *Brave New World* (1932). Science fiction had made the future visible in various forms – utopian and dystopian – in fictional works which created imaginative and at times amazingly accurate visions of the future.

It is interesting to note the impact which H.G. Wells' *The War of the Worlds* (1898) had when it was adapted to radio by Orson Welles in 1938. As the radio adaptation took on the style of a news bulletin, the futuristic scenario of Martians invading the world sounded so convincing to listeners that it created widespread panic amongst listeners who were convinced that an actual alien invasion was taking place.

The continued emergence of futuristic science fiction stories during the first half of the twentieth century and which included authors such as Isaac Asimov (1920 – 1992) and Arthur C. Clarke (1917 – 2008) inspired young people to look to the future and triggered the public's imagination to explore future possibilities, thus setting the scene and laying the foundations for a more formal academic field of foresight and futures studies. Neal Stephenson (b.1959), a more recent science fiction author, provided interesting examples of the repercussions of cyber-culture in his publication *Snow Crash* (1992), which vividly depicts scenes from virtual worlds, and later with *Anathem* (2008), which draws upon philosophical and metaphysical concepts, on quantum physics and on multiple worlds in an impressively imaginative manner.

Some of these themes have been popularized through movies which include *The Matrix Trilogy*, written and directed by the Wachowski brothers, James Cameron's *Avatar* and Christopher Nolan's *Inception.* Well known television series include *Star Wars*, *Star Trek* and *Doctor Who*. The latter is reputedly the longest running science fiction television series, originally having successfully been broadcast between 1963 and 1989 and re-launched in 2005 by BBC in England.

There is no doubt that science fiction utilizes the creative imagination to depict future scenarios in an innovative manner. It draws on the imagination and curiosity of human beings to depict and experience future visions and scenarios. Science fiction is but one way of depicting humanity's fascination with the future which is as yet unknown and it plays upon both hopes and fears, often utilizing specific personal 'stories' which may be

very effective in communicating certain future possibilities. It may, moreover, inspire or influence future events, one example being *Metropolis*, the 1927 German silent movie by Fritz Lang, which depicted a dystopian scenario where workers are treated like mechanical instruments (or cogs in the wheel) for the benefit of the higher management class of owners in a parody of the downside of an industrialized capitalistic society.

3.2. Formal Future Studies

The formal study of the future began under the direction of William F. Ogburn, director of President Hoover's Committee on U.S. Social Trends from 1930 to 1933. Ogburn developed the first catalogue of trends for the U.S.A. (*Recent Social Trends*, published in 1933). The innovative feature of this publication, which identified trends including widespread immigration and the rise of divorce, was the extrapolation of sociological trends and their application to the future.

The events experienced in WW II and during the Cold War gave rise to situations which required forecasting skills for both military and defense purposes. The need to design and produce state-of-the-art military technology which was not obsolete by the time it had gone through the production process, and which necessitated the anticipation of future technological capabilities and possibilities, gave rise to what later became known as technological forecasting.

War games which simulated combat were developed by the U.S. Department of Defense which collaborated with the RAND Corporation, the first U.S. government sponsored think-tank set up in 1946. War games allowed for the creation of possible future scenarios which, as Herman Kahn, a researcher at RAND claimed, allowed participants to 'think the unthinkable', particularly where nuclear warfare was concerned, through scenarios, in a context which allowed time for reflection, preparation and skill acquisition in problem solving and decision making.

3.3. La Prospective

Although efforts in the U.S.A. to harness methods such as trends, demographics and the extrapolation of data were the predecessors of what is today known as foresight, the French had successfully developed their own methods which were initially based on a review of the decision making process.

La Prospective, which implies the study of possible futures, is a method which was invented by Gaston Berger (1896-1960) and a forerunner of foresight. Berger's ideas on *prospective* played a key role in the history of foresight. His method is still very influential in France today. Durance (2010) describes the context which led to Berger establishing this method in France:

> The 1950s remained tainted by the barbaric acts committed during World War II. While relations became more international and more complex, France entered a period of unheard-of growth. Berger's techniques shook up many approaches and, for many intellectuals of that time, scientific discoveries created just as many, if not more, problems than they solved. In these circumstances, time passing faster

became part of experience, the normal law of change in the world. In this respect, 'the Future is ahead of [its] ideas'. The situations in which Man finds himself thus seem to always be new. The consequences of decisions will be seen in a completely different world from the one in which those decisions were made (Durance, 2010).

Durance (2010) further describes the manner in which Berger, a philosopher, viewed history and his innovative manner of moving away from entrenched perspectives and attitudes to create future visions which are not necessarily or logically continuous with the past:

> Gaston Berger, the philosopher, questioned neither the meaning nor value of history but rather its use in preparing to make decisions. Actually, history and *prospective* have a lot in common for they look at potential facts: the past is gone, the future is not yet. The past must serve to root out the unchangeable, heavy trends, which are useful in building hypotheses or operational rules, in other words, useful for action but not models whose simple application would substitute for analysis and focused thinking. These retrospective attitudes are no longer adapted. It is not possible to live off one's experiences (*aquis*). Anticipating using the past as a basis, even in its most scientific form (extrapolation) means determining what will happen if the studied event remains frozen in time thus timeless (Durance, 2010).

Berger's insights, which are still very valuable today, are impressive, as is his emphasis on practice and on specific applications as examples of how this new methodology could be applied, utilizing stakeholders. Moreover, it 'would serve to help human aspirations come to the fore', as Durance (2010) states, by both enlightening judgment and informing it, maintaining a normative stance.

Durance (2010) describes the 'six basic virtues' which Berger's 'position towards the future' relies upon. These virtues all have practical applications when related to creativity, innovation and foresight, as Durance states:

> The first, being calm, which is necessary for one to step back and maintain self-control. Imagination, the second, opens the door to innovation and lends the innovator a different, original, way of looking at things. The third is a team spirit. Team spirit is indispensable if action is to be efficient just like enthusiasm, which propels that same action and makes people capable of creating. Courage is also essential in order to get off the beaten track, innovate, be entrepreneurial and accept the inherent risks. Lastly, some sensitivity; i.e., to be aware of mankind's future, a society must put man first. To do so, culture must play a key role. Culture allows us to grasp the thinking of the Other. It also provides the possibility for us to understand before judging. Through its different forms, culture shows how people can take charge of their own fate (Durance, 2010).

Adoption of these key values would lead to the development of a prospective attitude which opens up possibilities for future visions and scenarios. Berger's *prospective* does not advocate the elimination of short-term predictions. However, it ambitiously attempts

to move further ahead towards the identification of long-term scenarios, taking an imaginative leap into the future, in an effort to eliminate all present doubts or uncertainties and to rid the process from habitual or routine ways of doing things. The end result is an innovative course of thought and subsequent action, with flexibility and risk-taking built into the process. Moreover,

> Given that the future belongs to what we call will or will power, *prospective* must have as its goal efficient action. ... The goal is not to observe the future based on the present but rather to observe the present based on the future. This twist requires us to choose a future from among the innumerable possibilities offered. It once again and thus puts forth the problem of action as goal. ... *Prospective* enables us to keep the ends, means and reality of current situations in a permanent state of confrontation. The need to connect the exploratory and normative is thus explicitly stated (Durance, 2010).

Everything is open to question and both the imagination (which takes the place of logic) and flexibility (to adapt to circumstances) are key elements in Berger's *prospective* where strategic action which leads to desirable goals is imperative.

Foresight in the form of *la prospective* has flourished in France, thanks to Berger's initial efforts. The French Government set up Datar, an organization for regional development (where prospective played a major role and was further developed), in 1963. Datar organized the first international conference on *prospective* and on regional development in 1968.

Bertrand de Jouvenel, a French futurist, wrote the first theoretical study of the future in *The Art of Conjecture published in 1964*. Jouvenel's claim was that, since there were no future facts, therefore non-traditional methods of inference were necessary. Jouvenel, who was involved in the 'art of political conjecture' (as opposed to a forecasting method), avoided using the word '*prospective*', preferring to speak of conjecture or *futurible* which, he claimed, designates 'the different possible futures according to different ways of acting'.

Prospective greatly influenced the economic, scientific, political and cultural activities in France as it was linked to planning and widely adopted. In an attempt to disseminate the ideas outside France, particularly in the U.S.A. where *prospective* was not yet well known, André F. Cournand, a Nobel-prize winner (medicine) and professor at Columbia University, joined forces with Maurice Levy, a professor at the Sorbonne and a colleague of Berger, to publish an English translation of *Shaping the Future* (1973). Cournand and Levy felt that *prospective* could contribute towards a number of issues related to decision making in the U.S.A. These included a combination of both philosophical reflection and a practical methodology to create future visions. As a 'missionary' for *prospective* in the U.S.A., Cournand was involved in a colloquium on *prospective* held at the Institute for Advanced Studies at Princeton in 1963 which was influential in introducing Berger's ideas into the States.

3.4. RAND Corporation and Shell

In 1964, Olaf Helmer and Ted Gordon, under the auspices of the RAND Corporation, conducted an extensive survey on new technologies which would occur in the next 100 years. Six topics were covered and the Delphi method was used. Experts first gave their responses to a list of set questions, these were then collated and re-distributed for further comments and discussion. Differences in the final responses were then discussed and new estimates provided.

Shell, the well known oil corporation, became involved in foresight in 1965 when it set up a system which was called UPM (Unified Planning Machinery). The initial methods they used were criticized for being too mechanical and were later replaced with scenario planning which yielded four explanatory scenarios and a change in the views of the managers.

Pierre Wack, who played a role in Shell's initiative, identified two basic features of scenarios which are valuable for organizations. The first involves the identification of predetermined elements (events which have already occurred and events which are very likely to occur). The second involves the attitudes of the managers who participated in the exercise and the manner in which scenarios impact on an organization. Shifts or changes in the world views of managers were visible as they re-worked their perceptions of reality.

Wack's insight reveals the importance of one of the learning outcomes of foresight activities. Although the goal of foresight is generally the identification of a vision or of various possible scenarios towards which strategic planning may be directed, the shift in attitudes and mindsets of those participating (the stakeholders and experts for example) cannot be denied. A more flexible outlook, together with the realization that it is better to strive towards a desirable future rather than to be 'stuck' in a status quo or simply to react to events as they occur, often instigates participants to move towards increased 'ownership' of the tools, methods and processes which they have learnt, with the result that additional foresight activities may be pursued.

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Acceleration Watch (2006) Futurist (definition): Common Types of Futures Thinking. h t t p : / / w w w . accelerationwatch . com / futuristdef . html accessed 08.11.10. [This website provides some definitions of the term 'Futurist' and a description of 'Futures Thinking'. It includes an interesting classification of different types of futurists and a brief history of 'Foresight and Futures Studies']

Andersen, M.M. and Jørgensen, B.H. (2004) Technology Foresight − The potential for wiring up the National Innovation System, January 2004. h t t p : / / w w w . iamot . org / conference / index . php / ocs / 4 / pape r / viewFile / 531 / 62 accessed 04.04.11. [This paper addresses the issue of technology foresight in Denmark. It critically investigates whether technology foresight may be used to wire up national innovation systems]

Beck, U. (1999) *World Risk Society*, Cambridge: Polity Press. [Beck's essays develop the concept of a 'world risk society'. He predicts a transition from 'first' to 'second' modernity (as opposed to postmodernity) or from 'simple' to 'reflexive' modernization]

Becker, P. (2002) *Corporate Foresight in Europe: A First Overview*, Working Paper, October 2002, European Commission. f t p : / / f tp . cordis . europa . eu / pub / foresight / docs / st_ c orporate_foresight_040109 . pdf accessed 18.08.11. [The EU Commission commissioned this research with the aim of obtaining an overview of the manner in which the private sector utilizes foresight (corporate foresight) and the subsequent impacts, problems and potential]

Beeton, D.A., Phaal, R. and Probert, D.R. (2008) 'Exploratory road-mapping for foresight', *Int. J. Technology Intelligence and Planning*, Vol. 4, No. 4, pp.398–412. h t t p : / / inderscience . metapress . com / index / f737131781378w6k . pdf accessed 18.08.11. [This paper explores the manner in which road-mapping may be used for knowledge exploration (as opposed to knowledge exploitation)]

Bell, D. (1973) *The Coming of Post-Industrial Society: A Venture in Social Forecasting*. [Bell provides a prediction of what he calls the 'post-industrial society' which is similar to what is referred to as the 'knowledge society'. This society is based on information and it is service oriented. It does not displace industrial society but it adds a new dimension to what previously existed]

Bellamy, E. (1888) *Looking Backward from 2000 to 1887*. [Bellamy's novel, which implicitly criticizes industrial capitalism, is set in the year 2000. It predicts a utopian socialist scenario with a number of technological advances]

Borch, K., Dingli, S.M., Jørgensen, M.S. (Eds.) (2012) (in press) *Exploring the Future: The Role of Interaction in Foresight*, UK: Edward Elgar. [This publication, which includes chapters written by experts, practitioners and academics in the field of foresight, provides theoretical analysis and case studies related to dialogue, learning, participation, dissemination, implementation, scenarios and visions, all of which are related to European Foresight experiences]

Borch, K. and Fredesvinda M. (2012) (in press) 'Dialogue in Foresight: Consensus, Conflict and Negotiation' in Borch, K., Dingli, S.M., Jørgensen, M.S. (Eds.), *Exploring the Future: The Role of Interaction in Foresight*, UK: Edward Elgar. [The chapter critically explores various aspects of dialogue in foresight experiences, with particular emphasis on issues related to consensus, conflict and negotiation. The authors claim that consensus should not be the primary goal of the foresight processes, which should consist of a process of negotiation among key stakeholders]

Brader, B. and Wilson, A. (2007) Presentation on 'Future Generation' at 'Strategic Futures Coaching', National Council for Higher Education, Valletta, Malta, July 2007. [The presentation addresses the concept of 'strategic futures analysis' in the context of scenario planning and the forces of change in higher education]

Casingena Harper J. (Ed.) (2003) *Vision Document*, eForsee Malta ICT and Knowledge Futures Pilot. [The document presents the results of the eForsee Malta Pilot on 'Exploring Knowledge Futures in Information and Communications Technologies and Education in 2010', conducted in Malta between 2002 and 2003]

Carson, R. (1962) *Silent Spring*, Houghton Mifflin, Boston. [Carson's book, which was extremely controversial and criticized when it was first published, but which later had a substantial effect on environmental issues, draws attention to the hazards of pesticides and other pollutants on human well being]

Club of Rome (1972) *The Limits to Growth*. [The authors propose a model to address the manner in which exponential growth may be dealt with. A shift towards global equilibrium as a goal for humans, in an effort to avoid depletion of resources, is proposed]

Costanzo, L.A. (2004) 'Strategic foresight in a high speed environment'. *Futures*, Vol.36, pp. 137-144 (Special Issue on Organizational Foresight, Eds. Tsoukas, H. and Shepherd, J.). [This is a case study which explores a stand-alone internet bank in the U.K. The research results point to the importance of agility and management practices. Developing strategic foresight is a learning process with a number of related challenges]

de Jouvenel, B. (1964, 1967) *The Art of Conjecture*, New York: Basic Books. [The author challenges the possibility of 'predicting the future' by proposing an alternative which he calls 'futurology'. This combines the imagination and subjective certainty and results in the generation of a variety of alternative futures, rather than the generation of only one future possibility]

de Lattre-Gasquet, M. (2009) 'Foresight', 21/04/2009 h t t p : / / knowledge . cta . int / en / Dossiers / S – T – Issues – in – Perspective / Foresighting / Articles / Foresight accessed 03.04.11. [This is a useful critical paper which brings out the difference between foresight and forecasting, emphasizing the importance of improved methodologies, interaction, proactive and collective action, particularly for decision making at policy level]

Dingli, S.M. (2012) (in press) 'The Dissemination and Implementations of Results of Forecast Activities' in Borch, K., Dingli, S.M., Jørgensen, M.S. (Eds.), *Exploring the Future: The Role of Interaction in Foresight*, UK: Edward Elgar, pp.180-96. [The chapter addresses the gap between foresight practice and action, the latter considered as the ultimate measure of successful dissemination. It draws on topics related to communication and emphasizes the importance of the diffusion of the results of a foresight exercise beyond the participating stakeholders]

Durance, P. (2010) 'Reciprocal influences in future thinking between Europe and the USA' in *Technological Forecasting and Social Change*, Strategic Foresight, Volume 77, Issue 9, November 2010, pp. 1469-1475. [This is an interesting journal paper which focuses on the main issues which led to the development of *la prospective* in France. It provides a critical historical analysis of this concept and draws together some reciprocal influences that subsequently emerged between French and American practitioners]

European Commission (2009) Strengthening the role of European Technology Platforms in addressing Europe's Grand Societal Challenges, Report of the ETP Expert Group, October 2009. f t p : / / f t p . cordis . europa . eu / pub / etp / docs / fa – industrialresearc h - b5 – full – publication – rp _ en . pdf accessed 18.08.11. [The report discusses the evolution, activities, roles, goals and achievements of European Technology Platforms with the aim of proposing recommendations for addressing Europe's 'Grand Challenges', which include sustainable economic recovery, and suggests this may be achieved through the Technology Platforms working in flexible clusters]

European Commission (2010) CORDIS – European Technology Platforms website. European Technology Platforms (ETPs are industry-led stakeholder fora charged with defining research priorities in a broad range of technological areas. h t t p : / / cordis . europa . eu/technology - platforms / h ome _ en .h tml , accessed 18.08.11. [This website describes the role of European Technology Platforms]

Federal Ministry of Education and Research, Germany (2008) (Activity conducted in September 2007) Bonn, Berlin, 2008. h t t p : / / w w w . b mbf . d e/ pub / foresight _ process . pdf accessed 03.04.11. [This is a two-page PR flier published by the German Federal Ministry for Education and Research (BMBF) which describes the objectives of the BMBF Foresight Process]

FOREN Guide (2001) Foresight for Regional Development Network - A Practical Guide to Regional Foresight (EU: December 2001) Edited by James P. Gavigan, Fabiana Scapolo, Michael Keenan, Ian Miles, François Farhi, Denis Lecoq, Michele Capriati, Teresa Di Bartolomeo, December 2001. h t t p : / / forlearn . j rc . ec . europa .e u / guide / 7_ references / foren . htm accessed 04.04.11. [This is an excellent guide to conducting foresight activities, compiled by an impressive team of experts. It should be useful for anyone considering the possibility of embarking on foresight activities, particularly at a regional level]

FOR-LEARN, JRC European Commission, The FOR-LEARN Online Foresight Guide. h t t p : / / forlearn . j rc . ec . europa . eu / guide / 0_home / index . htm accessed 04.04.11. [This attractive and informative website provides an excellent and comprehensive guide for novices as it outlines the various steps related to foresight activities in simple language and provides a number of definitions of key terms, including a useful glossary]

Florida, R. (2004) *Cities and the Creative Class*, Routledge. [Florida is renowned for his work on the 'creative class' and on the manner in which 'creatives' may be attracted to 'creative cities'. He outlines the importance of tolerance and the provision of desirable amenities, subsequently moving against the traditional and conservative view which advocates tax breaks, the provision of accommodation or economic incentives]

Friedman, T. L. (2005) *The World is Flat: A Brief History of the Twenty-First Century*. Farrar, Straus & Giroux. [Friedman is an award-winning New York Times columnist who makes use of narrative, utilizing relevant examples from different countries and contexts to describe and de-mystify the manner in which digital technology is influencing globalization, with governments, corporations and individuals having to adapt to what he called a 'flat' (or digitally connected) world]

Fuller, T. and Loogma, K. (2009) 'Constructing futures: A social constructionist perspective on foresight methodology', *Futures*, Volume 41, Issue 2, March 2009, pp. 71-79. [This excellent journal article emphasizes the importance of considering social construction (defined as 'the meaningful construction of social objects') and inter-subject meaning related to the knowledge (the assimilation and production of meaning by society) that emerges from foresight activities. They claim that 'Foresight is both a social construction and a mechanism for social construction']

Georghiou, L. (1996) 'The U.K. Technology Foresight Programme', *Futures*, 28, (4), pp.359-77. [This journal article, authored by a renowned foresight expert in the U.K., provides an interesting case study. It critically analyses the experience of the UK Technology Foresight Programme (1993-1995), providing a description of the various stages, the evaluation criteria and the implementation of the results of the process]

Georghiou, L. (2009) 'Exploring a Success Scenario for 2050 on Application of Breakthrough Technologies to Adaptation to Climate Change in Agriculture', FarHorizon Workshop, Brussels, 15 December 2009. h t t p : / / f arhorizon . portals . mbs . ac . uk / Portals / 73 / docs / adapting _ agriculture_LG . pdf accessed 18.08.11. [This power point presentation is part of a workshop exercise which aimed to identify breakthrough technologies and research and innovation strategies related to European agriculture and its capacity to adapt to climate change]

Georghiou, L., Cassingena Harper, J., Keenan, M., Miles, I., and Popper, R. (2008) *The Handbook of Technology Foresight,* Prime Series on Research and Innovation Policy, UK: Edward Elgar Publishing Limited. [The Handbook provides an excellent source of information for academics, practitioners and policy makers who intend to conduct research on the topic of foresight. It includes chapters by well-known experts in the field, comprising theoretical, methodological and practical (case study) considerations, with a key focus on technology foresight]

Georghiou, L. and Keenan, M. (2008) 'Evaluation and Impact of Foresight', in Georghiou, L., Cassingena Harper, J., Keenan, M., Miles, I., and Popper, R. (2008) *The Handbook of Technology Foresight,* Prime Series on Research and Innovation Policy, UK: Edward Elgar Publishing Limited, pp. 376-99. [This chapter discusses the complex issue of evaluation and impact of foresight applications, drawing on three national case studies. Criteria for evaluation are discussed. The conclusion emphasizes the importance of context and admits that there is still a great deal more to be done to better understand long term impact. There is no 'one size fits all' evaluation approach]

Godet, M. (2008) *Strategic Foresight La Prospective: Use and Misuse of Scenario Building*, with Philippe Durance and Adam Gerber, Lipsor Working Paper #10. h t t p : / / w w w . laprospective . fr / dy n / francais / ouvrages / SR10vEng . pdf accessed 06.04.11. [This working paper provides an excellent introduction to *la prospective*, which Godet translates as 'strategic foresight'. It includes a brief historical introduction to the topic, a step-by-step description of various methods and case studies]

Godet, M. (2010) 'Future Memories' in *Technological Forecasting & Social Change,* 77, 1457-1463. [Godet draws on his vast experience to emphasize the importance of participation, reflection, collective learning, action, simplicity, rigor and proactivity in the application of *la prospective,* which is understood as the construction of 'desirable futures']

Graves, T. (2007) 'Stealth Foresight for Innovation: Creating Support for Creative Change in Large Organizations in Australia' *Journal of Futures Studies*, November 2007, 12(2), pp. 121-128. (Tamkang University, Taiwan; ISSN 1027-6084). [Stealth foresight involves embedding foresight methods within the strategic development process in an organization in an attempt to incorporate long-term timelines,

participation, engagement, complexity and emergence to overcome resistance and a bias for short-term thinking and to support internal innovation]

Helmer, O. and Rescher, N. (1959) 'On the Epistemology of the Inexact Sciences', *Management Science*, Vol. 6, No. 1, October 1959, pp. 25-52. [This journal article argues for the use of expert judgment and simulation as a means of acquiring knowledge in the inexact sciences (such as applied social sciences), in contrast with regular science which is expected to provide predictions and explanations in an objective manner. One of the examples cited is the learning acquired from war game simulations which may be applied to real life situations]

Horton, A. M. (1999) 'forefront: a simple guide to successful foresight', *Foresight,* 1 (1), pp. 5–9. h t t p : / / w w w . agr I – peri .i r / A KHBAR / cd1 / F ORESIGHT % 20METHODOLOG Y %2 0 & % 20FORECASTING / FORESIGHT % 20METHODOLOGY / related % 20articles / philosophy / forefront . % 2 0 a % 2 0simple % 20guide % 20t o% 20sucessful % 20foresight . pdf accessed 17.01.12. [This article provides a brief and simple guide to the foresight process with particular emphasis on corporate foresight]

Huxley, A. (1932) *Brave New World.* London: Chatto and Windus. [In this satirical fictional narrative, Huxley exploits the anxieties of his era concerning Soviet Communism and Fordian Capitalism. His narrative elicits a revulsion of Pavlovian-style operant conditioning, where universal happiness involves drug rationing to do away with religion and with emotions related to love, family, suffering and pain, in an impressive depiction of what life may be like in a bland future, where everything is controlled and where suffering has been eliminated]

ICSU (International Council for Science) (2010) Scientific Grand Challenges identified to address global sustainability (last modified 18 February 2011). h t t p : / / w w w . I csu . org / news – centre / p ress – releases / 2010 / scientific – grand – challenges – identified – to – address – global - sustainability, accessed 26.09.11. [This is a press release which lists five Grand Challenges, identified by the international scientific community, which need to be addressed to enable global sustainability]

Irvine, J. and Martin, B. (1984) *Foresight in Science: Picking the Winners*, London: Francis Pinter. [This publication disputes the 'conventional classification' of R&D into 'basic research', 'applied research' and 'experimental development' and claims this is inadequate. Two different types of research activity are identified within 'basic research': 'curiosity oriented research' and 'strategic research'. Methods concerning the long term future for strategic research are discussed]

Johnston, R. (2007) 'Introduction to Foresight'. Presentation delivered at The Future of Technology Foresight in the South East Asia Region, Kuala Lumpur, Malaysia, 30-31.10.2007. [The power point presentation is an excellent brief description of what foresight is about. It includes some definitions, a list of some tools and a summary of the evolution of the foresight process]

JRC IPTS FTA Conference 2011, European Foresight. 'The 4th International Seville Conference on Future-Oriented Technology Analysis (FTA)', 12-13 May 2011. h t t p : / / foresight . jrc . ec . europa. e u / f ta_2011 / intro . html accessed 10.04.11. [This website provides information on a conference which focuses on foresight's role in addressing Grand Challenges and structural and systemic transformation, held in May 2011]

Kahn, H. (1962) *Thinking about the Unthinkable*, Horizon Press: New York. [Kahn, a futurologist and cold war military strategist, believed that nuclear war was probable and, in language accessible to the lay reader, shockingly and controversially postulated what winning a nuclear war would entail]

Kay, A.C. (1989) 'Predicting the Future', *Stanford Engineering,* Volume 1, Number 1, Autumn 1989, pp. 1-6. Excerpts available at h t t p : / / w w w . ecotopia . com / webpress / futures . htm accessed 10.04.2011. [Kay, whose experience includes his involvement as an Apple Fellow at Apple Computers and as a Disney Fellow at Disney Imagineering, provides interesting anecdotes which demonstrate how ideas have the potential to become innovations]

Kristóf, T. (2012) (in press) 'Learning Theory in Foresight' in Borch, K., Dingli, S.M., Jørgensen, M.S. (Eds.), *Exploring the Future: The Role of Interaction in Foresight*, UK: Edward Elgar, pp. 69-96. [The chapter situates learning theory within foresight, summarizing the historical development of learning theory and focusing on interaction, formal and informal learning, organizational learning, anticipatory action learning and social learning theory]

Kuhn (1962, 1970) *The Structure of Scientific Revolutions,* University of Chicago Press. h t t p : / / experiment . iitalia . com / librarysplit2 / Thomas % 20S % 20Kuhn , % 2 0 T he % 20Structure % 20Of % 20Scientific % 20Revolutions % 202 Nd % 20Ed . pdf. [Kuhn argues for discontinuity in scientific progress through the discovery of anomalies which lead to 'paradigm shifts', or revolutionary science, which disrupt the linear flow of 'normal science']

Loveridge, D. (1996) *Technology Foresight: Perspectives for European and International Cooperation* PREST, ANEP and University of Twente, Study for European Commission DGXII, 1996. [Loveridge, who was involved in the first UK Technology Foresight Programme, led a team for the EC's DGXII to explore how the EC could make wider use of technology foresight programs for collaboration]

Lundvall, B.-A. (1992) *National Systems of Innovation: Towards a theory of innovation and interactive learning,* London and New York: Pinter. [Lundvall emphasizes the importance of interactive learning, user-producer interaction and innovation in his analysis of national systems of innovation, where the success of innovative activities is dependent on political and cultural influences and on economic policies]

Mack, T.C. (2005) 'Organizational and Management Dynamics in Foresight', *Journal of Futures Studies*, February 2005, 9(3), pp. 73-80. [Mack, as President of the World Future Society, discusses foresight and some foresight tools in an organizational context. Foresight 'should serve as an addition to the existing management toolkit']

Martin B. R. (1995) 'Foresight in Science and Technology', *Technological Analysis & Strategic Management*, 7(2), pp. 139-168. [Martin provides an excellent analysis of foresight, considered as a process, drawing on his extensive experience and citing a number of international case studies. Foresight encourages improved communication, collaboration and shared commitment amongst different stakeholders, creating linkages that are essential for exploiting the potential of new technologies. Martin concludes with an interesting analogy between foresight and industrial innovation, drawing on the lessons learnt from the foresight process in various countries]

Martin, B. and Irvine, J. (1989) *Research Foresight: Priority-Setting in Science*, London: Pinter. [Martin and Irvine discuss the development of foresight in various countries. They view foresight as a process rather than as a set of techniques. The aim of foresight is not to make deterministic predictions but to outline a range of possible futures]

Martin, B.R. and Johnston, R (1999) 'Technology Foresight for Wiring Up the National Innovation System: Experiences in Britain, Australia and New Zealand, *Technological Forecasting and Social Change,* 60, pp.37-54. h t t p : / / w w w .a ciic . o rg . au / system /f iles / f4 / o222 /T echnology % 20Foresight % 20 fo r%20 Wiring % 20up % 20the % 20 National % 20Innovation % 20System % 20199 9 . pdf, accessed 20.08.11. [The authors discuss and compare the experience of three countries with foresight, namely, the UK, Australia and New Zealand. They argue that technology foresight plays an important role in relation to national innovation systems as it allows for an improved decision making process to shape the future, with resultant long-term economic and social well-being]

Mercier, L.-S. (1770) *L'Ann 2440* (translated into English as *Memoirs of the Year Two Thousand Five Hundred*). [Mercier provides an interesting depiction of Paris in the year 2440 in this utopian narrative, presented as a dream, where the extremes of wealth and poverty have been abolished. It is interesting to see how the resolution of injustice and the promotion of the idea of social change were perceived towards the end of the eighteenth century]

Miles, I. (2003) FORESIGHT TOOLS –SCENARIO PLANNING, PREST, University of Manchester, United Kingdom, UNIDO - Technology Foresight for Practitioners, Training course, 6-10 October 2003, Prague, Czech Republic. *ict t . by / Library / 06.zScenarioPlanning . ppt* accessed 22.01.12. [This is an interesting power point presentation which describes the usefulness, variety and application of scenarios as part of a foresight activity]

Miles, I. (2002) *Appraisal of Alternative Models and Procedures for Producing Regional Foresight.* Report prepared by CRIC for the European Commission's DG Research Funded STRATA-ETAN Expert Group Action, Manchester, UK: CRIC. [This essay provides a very useful overview of a number of foresight methods which are classified in terms of their function, outlining their use, limitations and challenges. It is directed mainly, but not solely, towards those involved in planning, implementing and evaluating regional foresight exercises]

Miles, I., Cassingena Harper, J., Georghiou, L, Keenan, M. and Popper, R. (2008) 'The Many Faces of Foresight', in *The Handbook of Technology Foresight: Concepts and Practice*, Eds. L. Georghiou, J. Cassingena Harper, M. Keenan, I. Miles and R. Popper, Prime Series on Research and Innovation Policy, UK: Edward Elgar Publishing Limited, pp. 3-23. [The chapter, which is the Introduction to the book, includes an interesting and useful discussion on several definitions of foresight. It describes the evolution of foresight through various 'generations' and concludes with an exploration of various rationales for foresight activities]

Ogburn, W. F. Ed. (1933) *Recent Social Trends in the United States*. President's Research Committee on Social Trends. Two volumes. New York: McGraw-Hill. [Ogburn was the Director of Research for President Hoover's Research Committee on Social Trends 1929-1933. This massive 1568 page report brings together empirical data from different disciplines to describe social changes in the USA between 1890 and 1930, attempting to provide an objective view that is intended to separate social science from politics and ideology]

Orwell, G. (1949) *nineteen eighty-four.* London: Secker and Warburg. [Orwell uses fictional narrative to describe a dystopian scenario of a 'big-brother' society. Censorship of thoughts, words and deeds is rife and total mind control and conformation to the 'party' within a totalitarian state are terrifyingly and vividly presented]

Popper, R. (2008) 'Foresight Methodology', in *The Handbook of Technology Foresight: Concepts and Practice*, Eds. L. Georghiou, J. Cassingena Harper, M. Keenan, I. Miles and R. Popper, Prime Series on Research and Innovation Policy, UK: Edward Elgar Publishing Limited, pp.44-88. [This chapter is a very useful resource for those who wish to learn more about foresight methods. It provides an overview of a number of methods, classifies the methods and offers tips for their selection and use]

Popper, R. (2009) EU Report Mapping Foresight: Revealing how Europe and other World Regions navigate into the future (2009). Directorate-General for Research, Socio-economic Sciences and Humanities and EFMN. h t t p : / / e c . europa . e u / research / social – sciences / pdf / efmn – mapping – foresight _ en . pdf accessed 10.04.11. [This report presents the results of a foresight mapping exercise which collected data from over 2,000 foresight initiatives conducted in Europe and other world regions between 2004 and 2008]

Rubel, R.C. (2006) 'The Epistemology of War Gaming', *Naval War College Review,* Spring 2006, Vol. 59, No. 2 pp.108-128. h t t p : // w w w . usnwc . edu / getattachment / 5fce9410 - 594b - 47bf - af57 - 4cf5e406e634 / Epistemology-of-War-Gaming,-The---Rubel,-Robert-C- accessed 23.01.12. [This interesting paper discusses the epistemology of war gaming and investigates whether the knowledge that emerges is valid and useful. Rubel argues that valid knowledge can emerge from war games, but effort is required to work towards 'truly professional war gaming']

Sargent, L.T. (1976) 'Themes in Utopian Fiction in English Before Wells', *Science Fiction Studies,* No. 10, Vol. 3, Part 3, Nov. 1976. h t t p : / / w w w . depauw . edu / sfs / backissues / 10 / sargent10art . htm accessed 23.01.12. [Sargent claims to have read every utopia published in English from 1516 to 1975 and he describes the themes that emerge until the impact of H.G. Wells]

Schumpeter, J. (1942) *Capitalism, Socialism, and Democracy.* [Schumpeter, who claims to be analyzing trends rather than advocating a political view, provides an extremely interesting analysis of capitalism which is portrayed as continually undergoing change. He argued that capitalism would be replaced by socialism. Schumpeter popularized the term 'creative destruction', a disruptive process that comes about with radical innovation]

SESTI: Scanning for emerging Science and Technology Issues. h t t p : / / w w w . sesti . info. [This website describes the SESTI project which ran from October 2008 until June 2011 and which was funded through the EC's FP7 program. The aim of the project was to identify weak signals and emerging issues, mainly related to cognitive enhancement, health and energy]

Slaughter, R. (2003) 'A new framework for environmental scanning' in *Reframing Environmental Scanning: A reader on the art of scanning the environment*. Monograph Series 2003, No. 4, Ed. Joseph Voros, Australian Foresight Institute, Swinburne University, Australia, pp.19-36. [Slaughter argues for the application of a broader scanning framework than that which is generally practiced. He describes the limitations of conventional environmental scanning and proposes a new model. This new model involves

four quadrants that incorporate objective (outer world) and subjective (inner world) awareness and understanding, leading to increased depth where environmental scanning is concerned]

Slaughter, R. (2004) 'Prelims', *Futures Beyond Dystopia*: *Creating Social Foresight*. [Slaughter discusses the manner in which dystopian futures can provide motivation for change. He claims that the perception of danger is the first step on the road towards dealing with them. Human beings are motivated to avoid future dangers and feel the need to create plans to move forward]

Smecher, A. (2008) 'The Future of the Electronic Journal', *NeuroQuantology*, Guest Editorial, Vol. 6, Issue 1, pp. 1-6. [In this interesting paper, Smecher discusses the benefits of electronic publishing, particularly where academic journals are concerned. Electronic publishing presents a great deal of possibilities and it provides 'easy, immediate, non-discriminatory access to cutting edge research']

Special Eurobarometer 282 (2007) Scientific Research in the Media, Report, December 2007. h t t p : / / e c . europa . eu / public _ opinion / archives / ebs / ebs _ 282 _ en . pdf, accessed 18.08.11. [This report presents the results of a survey conducted in the EU on the level of interest in scientific research, citizens' evaluation of the manner in which scientific research is presented in the media and EU citizens' preferences and expectations concerning the media's treatment of scientific research]

Stephenson, N. (1992) *Snow Crash*, New York: Bantam. [In this futuristic novel, Stephenson interestingly describes the metaverse which is an immersive and interactive three dimensional virtual world where avatars interact with each other. Although the term avatar originates from Sanskrit, Stephenson popularized its use and it is now widely used for a graphical representation of a user or of a user's alter ego in computing, particularly among those who participate in virtual worlds or interactive online games]

Stephenson, N. (2008) *Anathem*, William Morrow. [This is a very slow moving, extremely detailed and lengthy science fiction novel, set in a future universe, which deals mainly with issues related to metaphysics, mathematics and physics. Although the author uses some fictional terminology and provides a useful glossary, the ideas which are discussed relate to actual science, philosophy and mathematics]

The Foresight Project (1997) *Sci-Tech,* Newsletter from MORST 8 (3) August, 1997, p. 1, cited in Martin and Johnston (1999). [This involves the announcement of a foresight project in New Zealand by the Ministry of Research, Science and Technology to establish science and technology priorities]

The University of Houston: Technology, 2011. h t t p : / / tech . uh . edu / programs / graduate / futures – studies – in – commerce , accessed 08.11.2010. [This website describes Futures Studies as part of a graduate program at the University of Houston]

Toffler, A. (1970) *Future Shock,* New York: Bantam Books. [Toffler, a futurist, deals with the accelerated rate of change and with human being's ability to deal with it. Sudden change or 'future shock' may give rise to social problems as it tends to overwhelm individuals and societies, leading to disorientation, alienation, stress and breakdown as a result of failure to adapt]

Toffler, A. (1980) *The Third Wave,* New York: Bantam Books. [Toffler's influential publication, which includes a number of future predictions, describes the three 'waves' of society, transitioning from an agrarian society to a standardized and organized industrial society and on to a post-industrial or information age 'third wave' society]

Wells, H.G. (1898) *The War of the Worlds,* United Kingdom: William Heinemann. [In this science fiction novel, Wells, who was influenced by Huxley and by Darwin's ideas on the survival of the fittest, presents a brutal battle for supremacy between humans and Martians who are invading England]

Wells, H.G. (1895) *The Time Machine,* United Kingdom: William Heinemann. [Wells provides an interesting, innovative and imaginative narrative on time travel (he is likely to have been the first author of science fiction to deal with the concept of time travel). Future humans are depicted as having evolved into two species, the Eloi and the Morlocks. Future progress is depicted as destructive for both humans and for the planet]

Yousuf, M.I. (2007) 'Using Experts' Opinions through Delphi Technique', *Practical Assessment Research and Evaluation,* Vol. 12 (4). h t t p : / / p areonline . net / getvn . asp ? v = 12 & n = 4 accessed 20.08.11. [This paper discusses the strengths and weaknesses of the Delphi technique and includes a discussion on the stages to be followed when adopting this method, panel selection and consensus]

Biographical Sketches

Dr. Sandra M. Dingli is the Director of The Edward de Bono Institute for the Design and Development of Thinking at the University of Malta (h t t p : / / w w w . u m . e du . mt / create). As a Senior Lecturer she delivers lectures on creativity, innovation, foresight and new digital technology to undergraduate and postgraduate students. The Institute was initially set up in collaboration with Professor Edward de Bono, the inventor of lateral thinking, in October 1992. In 2004 Sandra designed and launched a new postgraduate degree, a Master of Arts in Creativity and Innovation, which attracts international postgraduate students to the University of Malta. In 2009 she successfully launched an international joint MSc in Strategic Innovation and Future Creation which is delivered together with three other EU Universities mainly by e-learning. Sandra has published extensively in the UK and in Malta. She is regularly invited to deliver presentations and workshops at local and international conferences, mainly on topics related to creativity, innovation management and foresight. Her training experience includes workshops she has conducted in Australia, New Zealand, Canada, USA, India, Singapore, Malaysia, Finland, Czech Republic, England, Italy and Scotland. Sandra has also participated in a number of European funded projects, one of which she has coordinated and where she plays a very active role.Sandra obtained her MA from the University of Malta and her PhD from the University of Durham in the UK. She visited the University of Manchester's Institute of Innovation Research as a visiting researcher. She is regularly invited to evaluate projects by various European research institutes. Sandra's research interests are mainly in the areas of innovation management, foresight, new digital technology, e-learning, philosophy of mind, artificial intelligence and innovation policy. Although she now dedicates most of her time to research and lecturing, her extensive work experience includes participation in the sectors of art and culture, tourism, human resources development and television production.

Jennifer is an experienced R&I policy and foresight practitioner with an in-depth knowledge of EU R&I policy and an academic background as well as experience of working with policy makers at high level. She is the Director of Policy, Strategy, FP7 and International within the Malta Council for Science and Technology with core responsibility for the National Research and Innovation Strategy and Foresight and links with the European Union. She represents Malta at European Union level in the Competitiveness Council and CREST/ERAC at DG level. She has served two terms as a member of the JRC Board of Governors.She has been active on nine EU DG Research High Level Expert Groups as rapporteur and she was a member of the JRC Future-oriented technology Analysis Conference Committee in 2007, 2009, 2011. She has coordinated national foresight projects and three iterations of national R&I Strategic Plan including FP participation since FP4. Dr Harper is active in numerous EU projects and studies – she is currently coordinating an FP7 OMCNET project ERA-PRISM and has been active in a number of EU Framework Programme foresight projects, including eFORESEE, ForSociety, INNFORMED, FUTURREG, FARHORIZON and SESTI. She is a graduate of Keele University, and the London School of Economics. Her doctoral research, which focused on the internationalization of S&T Policy, was carried out at the University of Malta and Sussex University (SPRU). She lectures in foresight within the University of Malta's Masters Programme in Innovation and Creativity. Her research interests include International Level Foresight and STI Policy with particular emphasis on transition economies. She has published a number of articles and papers in international publications, namely *Innovation Policies in Europe and the US* (Ashgate, 2003) and has recently co-edited *The Handbook on Technology Foresight* (Elgar 2009). She has been a member of invited international panels and is a member of advisory board for the Russian Higher Institute of Economics. She was a member of the EU JRC IPTS Enlargement Futures Committee and is MCST's contact within the JRC's European Techno-Economic Policy Support Network. She is also active as an evaluator, rapporteur, project reviewer and independent observer of the evaluation process within the EU's Framework Programme. In Malta, she is a member of the National Commission for Higher Education, the National Data Protection Tribunal and Young Enterprise Malta Board of Directors.