CHAPTER 4

Foresight Knowledge – Science or non-Science?

4.1 Introduction

As stated in the final section of Chapter 3, foresight methodology is one of the major issues that is still besetting the practice of technology foresight. While foresight activity is seemed inevitable, many however wonder whether foresight results can be taken seriously. The underlying psychology barrier that causes this uneasiness is the distrust of foresight study as a "scientific" discipline.

A veteran foresighter, Olaf Helmer, who is also the founder of the renowned Delphi Method, has remarked that foresight methodology and incorporation of foresight in policy planning are two areas in future study which have seen limited progress over the last few decades. He attributed this partly to the lack of confidence with future study which is deemed "an inexact science" and lacking "scientific underpinnings" (Helmer, 1989: 39). In fact, another practitioner of future study, comments that

> "The futurist seen as scientist or practitioner of a discipline is unrealistic. The futurist seen as artist or craftsman, however, is a solid view" (Coates, 1989: 17).

The quest to lift the status of forecasting from "conjectural art toward science" had started decades ago (Amara & Salancik, 1972). However, over the years, practical experiences showed that the accuracy of foresight result is far lower than that is achievable by natural sciences. This suggests to us a possible fundamental incompatibility and incomparability of these two fields of research.

In this chapter, we will examine some of the debates on this issue of science and non-science. By studying the differences between physical and social reality, we will be able to understand the limits and possibilities of the practice of technology foresight as a kind of social study.

4.2 Science and non-science

The triumph of scientific knowledge in the last few centuries had prompted man to differentiate knowledge into "scientific" and "unscientific" categories. This could be understood as efforts to distinguish genuine knowledge from false knowledge. One of the influential demarcation criteria was proposed by Karl Popper. He suggested that knowledge claimed to be scientific must fulfil the criterion of "falsifiability", that is, "capable of being tested by experience" (Popper, 1980: 40-42).

The modern scientific method that we are practising today has its root ways back to 17th century. The pioneer of this method is Francis Bacon. He first suggested

that the best way of acquiring genuine knowledge is to cross check an argument with sensory observations (Velasquez, 1994: 335). This method of knowledge acquisition was later termed as "Method of Induction" by John Stuart Mill (ibid.: 336). Since our senses can only detect physical reality, as a result, scientific facts acquired through sensory observation are basically physical facts. This is still hold today and it is called empirical facts.

When physical facts become the basis of knowledge construction, postulates must at the end be referred to natural phenomena for confirmation before being accorded the "scientific" status. Over the years, this way of knowledge acquisition had become doctrinaire. Today, science has become the one word that enjoys various positive connotations of reliable, accurate and true knowledge.

As stated earlier, the demarcation of science and non-science will have a bearing on technology foresight. As foresight study deals with "future facts", or *futura* (Jouvenel, 1967: 3), it is thus difficult to convince policy makers and knowledge users to trust them. Future facts have no immediate physical reality. As such, by the standard of science mentioned earlier, it is not surprising if foresight knowledge is deemed unscientific.

In the ultimate analysis, the uniqueness of scientific knowledge is related to the means – the scientific method – through which it is acquired. In this chapter, I will examine the meaning of scientific method and scientism – the believe that only

scientific method is capable of valid knowledge. This will be followed by critical scrutiny of scientific method by some of the philosophers of science such as Karl Popper, Thomas Kuhn and Paul Feyeraband. This will help to clarify some of the invalid claims of scientism.

As technology foresight can also be considered as one type of social studies, discussions on the differences between the social and natural science has its relevancy here. By examining the basic tenets of physical research and comparing it with social research, we can help to highlight the problems of the application of scientific method in social studies and technology foresight.

4.3 Scientific method

Basically, a scientific method involves several steps that must be strictly followed. It starts with a problem, which is stated as a hypothesis. This hypothesis is subsequently tested with controlled experiment (Bilich, 1989:13). In this controlled experiment, artificial conditions are introduced to observe changes of physical properties of a matter. Based on the observation, the hypothesis will either be accepted as true or refuted as false. An accepted hypothesis is called a theory, which upon repeated cross-examinations will be confirmed as the law of nature if it retains its consistency.

Although these stringent procedures of testing and verification has won scientific method much fame, but the authority of scientific method is chiefly attributed to "observation". With scientific method, all claims of knowledge must undergo observational verification. Observation is done with our five senses, some with the helps of scientific instruments. No knowledge will be deemed scientific if it can not prove itself with empirical evidences. This means that science only acknowledge knowledge of "seen" world, knowledge of "unseen" world is irrelevant unless it can be made "seen" with the help of instruments. In addition to that, the observation is also done repeatedly, until the number of observations are huge enough to eliminate possibility of an event happens by chance. As stated by Fisher (1975: 37), "Scientists make generalisations and attempt to formulate explanations of that which is observed. These explanations are then tested with further observations. Throughout the entire process, observation is authoritative." It is this criterion that other social studies strive to follow. However, as we can see later, human environment is much more precarious, thus the repetition of observations is a much more difficult task to accomplish in social studies.

4.4 Science and scientism

The belief that scientific method is the only method capable of finding true and genuine knowledge is called scientism. *Webster English Dictionary* defined "scientism" as "a thesis that the methods of the natural sciences should be used in all areas of investigation including philosophy, the humanities and social sciences; (it is)

a belief that only such methods can fruitfully be used in the pursuit of knowledge" (Fischer, 1975: 68). This kind of "academic scientism" only started in the 19th century. Before this, "science" is only generally regarded as any orderly knowledge (Ziman, 1984: 187).

There is a tendency to identify scientism with scientists. This is a prejudice. In reality, an advocate of scientism can come from any background, be it science or non-science. A believer of scientism could be a sociologist or even religious leaders, who sometimes has no adequate understanding of scientific method itself. On the other hand, a scientist can be very critical of scientific method and fully acknowledges its limitations. He will not insist on the use of scientific method in every kind of research activities. In this case, the scientist can not be perceived as a pursuer of scientism.

Scientism is an ideology that has exalted science to a status of the highest level where no rivalry will be tolerated. It claims that no knowledge is genuine except those that had been acquired through the usage of scientific method. This inevitably will declassify certain religious knowledge from "scientific" category. Knowledge that can not be referred to natural phenomena for verification can not be accepted as scientific knowledge thus lack credibility. Eastman (ibid.) put it rightly when he suggested that scientism has "denatured God but deified nature".

4.5 Challenging scientism

Confronted by this forceful ideology of scientism, scholars basically deal with it with two approaches. First, by scrutinising the scientific method and point out its weaknesses and inadequacies. By doing this, they specify the limit of scientific knowledge, thus "dilute" the credibility of scientific method. Second, by arguing that social research as a different type of research which does not share the same volition and purpose of natural science research. As such, the criteria used to judge social knowledge should not be the same as the criteria used in judging knowledge of natural science. For instance, Huer (1990) suggests that social science should be judged by its relevancy and contribution to society, not validity, since to his opinion, there is no "valid" social knowledge in the sense of "valid" science knowledge. He opined that social studies do not aim at unveiling the "true" social reality, since there is no one "true" social reality but several contesting social realities. We will now take a look at the first approach, which suggests that scientific method is not as credible as claimed by the proponents of scientism.

a. Problem of induction

Scientific method can be perceived as an inductive method. As in Section 4.2 of this Chapter, this method was propounded by Francis Bacon in 17th century as a way of establishing reliable scientific knowledge, which was then coined as "method of induction" by John Stuart Mill in 19th Century. In this method, repetitive

observation is being made on a particular fact. And from these similar and repetitive facts, a generalisation is then deduced which will later be accepted as a general law.

However, a major problem with induction is that "every generalisation has to go beyond the observations on which it is based" (Velasquez, 1994: 337). Stated by Popper as "Hume's problem of tomorrow", he pointed out the fact that regardless of the number of observations one has made about a particular event, one can not conclude with certainty that the very next event will turn out the same as the previous one. The problem of induction can be illustrated by Russell's metaphor of the "inductivist turkey" (Vught, 1987: 187).

> "This turkey found that, on his first morning at the turkey farm, he was fed at 9 a.m. However, being a good inductivist, he did not jump to conclusions. He waited until he had collected a large number of observations of the fact that he was fed at 9 a.m., and he made these observations under a wide variety of circumstances, on Wednesdays and Thursdays, on warm days and cold days, on rainy days and dry days. Each day, he added another observation statement to his list. Finally, his inductivist conscience was satisfied and he carried out an inductive inference to conclude, 'I am always fed at 9 a.m.'. Alas, this conclusion was shown to be false in no uncertain manner when, on Christmas Eve, instead of being fed, he had his throat cut. An inductive inference with true premises has led to a false conclusion."

The argument Hume put forward challenged the very fundamental notion of causality. In our daily life, we are very used to connecting one event with another by suggesting that there exist a causal relation between them. In other words, we believe that every event have a cause that effected it. For instance, we feel pain when we are pinched; and we believe that our pain is caused by the pinch. This seems logic and making great sense to most of the people. However, according to David Hume, there is no a necessary connection between the first event with the second. In other words, there do not exist a necessary connection between the act of pinching with the feel of pain. What actually exist is only that both events "are contiguous in time and space, and that the object we call cause precedes the other we call effect." (Hume, 1960: 3).

The problem of induction remained unresolved. It is a valid question that destabilises the claims of scientism. Though we continue to do science with repetitive observations and drawing generalisations from these observations, we nonetheless will always be reminded of the limitation of these observations and the uncertainty that is inherent in scientific method. This problem has prompted Popper to redefine the meaning of scientific method and suggest a different criterion to characterise scientific method. The following section makes an exposition on this.

b. Corroboration or Falsification?

In the preceding section, we have seen how the so-called inductive "scientific method", which relies on repetitive observations could be problematic. In this section,

we will find that though scientific method requires a higher degree of rigorousness in its undertaking, it nonetheless contains weaknesses and uncertainty. Scientists realise that scientific knowledge is not equivalent to truth. It is only genuine knowledge in certain contexts within certain conditions. Beyond that, its representation is fallible. This recognition of inadequacy in scientific method leads to suggestions that scientific knowledge is provisional. A well accepted scientific theory today might be found inadequate tomorrow. A prominent scientific theory can be refuted and replaced in future upon fresh discovery, which may again be refuted in future. Thus, scientific truth is not the ultimate truth.

Karl Popper is one of the main proponents embracing the idea that scientific knowledge is tentative. According to Popper, a scientific method is not a method that seeks confirmation (as done by inductionists), but rather refutation. It is easy for one to obtain confirmations for every theory, if one looks for it (Popper, 1972: 36). However, by ways of confirmation, a scientific method can not be distinguished from methods employed by soothsayers. Soothsayers often have no difficulty in claiming evidences for their prophecies, but the question is whether those evidences are "testable", "refutable" or "falsifiable". If evidences are not testable, then we can not be sure that they are only coincidences which happen by chance. In other words, the foresighter may has hit the answer by guessing. And a good guessing is far from a good reasoning by scientist.

The way by which Popper demarcates science and pseudo-science is through the criterion of falsification. According to Popper, scientific hypothesis must be capable of being falsified through empirical observations. A good scientific theory is a theory that is refutable yet has not been successfully refuted after rounds of attempts to bring it down. This criterion of falsification differentiates scientific method from other realms of investigation which Popper sometimes accorded as pseudo-science. For instance, astrologers do not seek to falsify their hypothesis by empirical observations. The most they would do is to point out cases of incidents which "confirm" their suggestions. But the audiences will be left to wonder whether this confirmation is by chance since there is no effort to try to "falsify" it by means of empirical observation.

The criterion of falsification is one of the most stringent criteria one can apply to scientific analysis. Though by this criterion, Popper elevated scientific method to a higher ground then other fields of investigations in terms of its rigorousness, however, it also implies that scientific discovery are tentative and may be dropped in future. As a result, scientific knowledge in Popper's term is not the ultimate knowledge of truth and thus is opened for contention.

c. Science: a psychological phenomenon?

Though Popper intends to apply the criterion of falsification to differentiate science and pseudo-science, but in reality, this standard may not be the one held by

scientists. Thomas Kuhn, an American philosopher of science and a physicist, through his study of history of science found another aspect of scientific investigation. From his research, he realised that Popper was too optimistic in proposing the "falsification" criterion. He made two important observations in his study. First, he found out that scientific advancement is by way of revolution, not evolution. And second, he caught sight of the fact that scientists did not work individually; thus the establishment and abandonment of a scientific theory does not rely on individual scientist but the community of scientists (Chalmers, 1978: 85). A better scientific theory, upon its revelation, will not automatically replace the inferior old theory. Rather, it will have to first gain the acceptance and popularity among other scientists before being acknowledged as a new discovery. In other words, a wrong theory will not be "falsified" immediately as wished by Popper.

It is an important observation by Kuhn that refutation and acceptance of a scientific theory does not rely on individual discovery. It means that a truer scientific theory will not gain approval until majority members of the scientific community endorse it. This contradicted Popper's suggestion that science advances whenever new evidences are found and old theory is being falsified. It is at this point that Kuhn disagrees with Popper. To Kuhn, there is a psychological factor to be considered here. Scientific truth will not prevail upon its discovery, but it needs approval from members, especially those with "authority" in the particular field of scientific investigation.

Kuhn's idea of scientific progress can be simplified into the following sequence. Science first develops from a prescience stage to normal science. At the prescience stage, scientific activities are diverse and disorganise. Theories are proposed with no definite conclusion. But slowly they are structured into a single coherent theory which marks the arrival of the normal science stage. A paradigm[1] has thus emerged. At this stage, the theory that reigns will dominate the discourse among members of scientific community. And it will also be taught at school and to new scientists. However, this theory is not final. Time will come where new evidences incompatible with the theory are encountered. At this point, scientists will try to defend the old theory with additional explanations. However, when the evidences become more apparent, science will enter another stage, that is the crisis stage. At this stage, anomalies happen and scientists start to lose faith of the old theory but are still not ready to endorse the new one. With more and more evidences unearth, the old theory slowly becomes indefensible, more and more people will come to accept the new theory, and a revolution thus happens. This revolution is to overthrow the old paradigm and replaces it with a new one. At this stage, the cycle repeats and science returns to its normal stage again.

From the forgoing discussion, it is apparent that scientific investigation is not as rational and objective as it professes. A new and better theory will not gain immediate acceptance regardless of its profound exquisiteness. There are two

[1] According to Kuhn, a paradigm is "what the members of scientific community share..."(Kuhn, 1970: 176). A new paradigm emerges when a scientific achievement is "sufficiently unprecedented...and sufficiently open-ended to leave all sorts of problems for the redefined group of practitioners to resolve" (ibid., 10).

important implications in Kuhn's argument. First, the denial of scientific knowledge as ultimate knowledge, since it is bound to be replaced in the next round of "revolution". Second, at any period of time, especially at the "normal" stage of scientific development where discrepancy of a theory is minimum, one can not take scientific knowledge for granted simply because it may be refuted at a later stage.

d. Science as a myth

Another critique of idolisation of science came from a philosopher of science Paul Feyeraband. In his view, "science is much closer to myth than a scientific philosophy is prepared to admit" (Feyeraband, 1978: 295). As he pointed out, Galileo prevails not due to the authenticity of his claims, but because of "his style and clever techniques of persuasion..."(ibid.: 141). He made an analogy between science and religion, and ultimately with myth. While scientific method triumphs and proves itself to be effective in certain aspect, what advocates of scientism fail to understand is that "every methodological rule is associated with cosmological assumptions" which are taken for granted to be correct" (ibid.: 295). Thus, the practice of science is no less dogmatic then the practice of religion. At the same time, the supremacy of scientific method does not require majority approval. Scientific method has unquestionably become the only method of research accepted and taught in schools and most of the other education centres. It will sound insane to suggest one to teach magic and witchcraft in these institutions. Other systems of knowledge, which does not fit into the scientific category, or incompatible with it, will be "viewed as something

horrifying" or is "simply declared to be non-existent" (ibid.: 298). Feyeraband further suggested that "anything goes". In other words, any method of investigation is acceptable, on the ground that development of science is itself a result of deviations from ordinary practices. Deviation from ordinary is a necessity of progress (ibid.: 23).

It is obvious that criticisms of science towards other realms of knowledge seeking may not be justifiable since the knowledge produced by "scientific method" itself is not as authentic as it proclaims. The knowledge constructed by scientific method is not infallible. Nonetheless, to be critical of scientific method does not mean to disregard it as a whole. The prudent attitude of scientific investigation, for instance, should not be discarded.

4.6 Social vs. natural science

The answers to scientism can come from two directions. First, by discrediting scientific method and second, by arguing that social reality is a different realm of existence; and as a result, scientific method is not applicable there. In the foregoing section, we have seen various possible faults of scientific method. We have seen that scientific method is also fraught with unproven assumptions, which is the very attack it launches against other non-scientific methods. However, by showing the weaknesses of others does not justify ones own weaknesses. Methods of social study generally and foresight methodology particularly have to prove its credit by its own

account. Thus, in the following section, we will look into arguments supporting the usage of methods other than scientific method in social study.

a. Complexity

One of the strongest objections to the application of scientific method in social studies is based on the reasoning that social reality is a much more complex reality, and scientific method is unable to capture the full range of social reality (Hayek, 1978: 24). Social phenomena is a complex phenomena, it is constructed by a large number of variables. In order to explain and make prediction out of it, one has to study all these variables and it is extremely difficult for a social scientist to take into account of all the variables involved. Besides, these variables are also difficult to measure. In event where measurement is done, we do not know how reliable the data is since data of social science could be subjective (Hayek, 1979: 41-60). For instance, in social reality, it is not unusual for two persons to react differently to one similar event and conversely, it is also likely that the two persons reacted similarly to two dissimilar events.

As analysed by Popper (1960: 12), the complexity of social study as compared to natural science is twofold. First, the complexity arises from the difficulty to have artificial isolation of social events for social analysis. As such, controlled experiment similar to natural science can not be done. Second, social reality is indeed much more complicated than natural environment since it involves psychological aspects of

individuals which is complex and uncertain. As a result, though forecasting is possible in social science, it can only summarise general characteristics of future and is not able to provide detail description of a particular event which is expected to take place in future (Hayek, 1978: 33).

b. Controlled experiment

One of most frequently mentioned sources of difficulty in social study is the limited range for controlled experiment (Nagel, 1961: 450). The same was suggested by Popper (1960: 8-9). In his critique on historicism, he criticised the idea that historicists can prophesy as physical scientists, simply because "ordinary prediction in science are conditional" and this can only be achieved if the system is "well-isolated, stationary and recurrent". This system is in no way near to social realms, where conditions change rapidly and not within human manoeuvre. Even if artificial conditions are introduced, observations will be meaningless simply because it disrupts normal responses of individual which one tries to understand. Besides, the presence of memory (history) in human psychology also renders any experiment unrepeatable. A repetition of experiment, even with the same external conditions, can hardly derive the same reaction from a person because his earlier experience will teach him what is expected from him and the "proper" reaction. This earlier experience can not be eliminated without hurting his original conditions. It will leave a trace and alter the reaction of respondent towards the repeated experiment. As stated by Popper, "History may repeat, but never on the same level..." (ibid.: 10).

c. Non-existence of social laws

It is also doubtful whether social laws exist like physical laws. The law of gravitation is stable throughout different period of history and is similar at different places on the earth. However, the same does not apply to social reality. Human behaviour change throughout history. They are different from one race to another and from one place to another. Society develops and changes significantly. Thus, the search for social laws is a futile effort, "for social uniformity is not laws of nature, but man-made" (Popper, 1960: 7).

Stability of human behaviour is due to certain social norms or normative values which remains unchanged over time. Maintenance of these normative values is sometimes achieved through coercion (Huer, 1990: 11). Thus, this is the stability of "cultural rules" (not natural laws), which is itself unstable and has been changing throughout human history.

Apart from that, human social behaviour is also culturally instituted. Cultural diversity is a social reality. It is doubtful whether there exist trans-cultural social law which is applicable in every society (Nagel, 1961: 459). Cultural relativity is more plausible as a sociological principle.

d. Exact vs. inexact science

There is also an inclination to distinguish physical and social sciences on their degree of exactness in analysis. The common perception is that physical sciences are exact sciences since the methodology in used requires precise measurement, or in other words, measurement of physical sciences is quantitative. Every result of scientific experiments can be described in numerical terms. To illustrate, for instance, in physical science, colour can be described in qualitative terms such as red and also in quantitative terms such as wavelength. However, this is hardly possible in social sciences. Although economic study has achieved profound quantification of variables, nonetheless, for other field of social sciences, it is still far from satisfactory. For instance, one can hardly describe an angry person in numerical term. It is also difficult to measure the intensity of say, industrialisation. One can only use very vague terms, and very rough scaling, if at all possible, to substitute a description (Popper, 1960: 24-26). Besides that, physical laws must be able to be summarised into mathematical formulas. This is, in social reality, again beyond the ability of social scientists.

In instances where quantification of social parameter is done, the measurement is only ordinal (Black & Champion, 1976: 178-179; Mohd Hazim Shah Murad, 1995: 8). In ordinal measurement, the magnitude of change between two consecutive integers is not constant. For example, magnitude of change between "weak" and "strong" is not the same as magnitude between "strong" and "very strong". Whereas

in physical science, measurement is cardinal, in the sense that magnitude of change can be marked with exact figure. Degree of changes in temperature from 4°C to 5°C is the same as changes from 8°C to 9°C.

According to Olaf Helmer (1983: 25-50), the lack of ability of social scientists to quantify their research finding is not due to their lack of contemplative power, but is simply a result of the nature of social complexity. However, he does not agree with the idea of demarcating exact and inexact sciences base on the extent of quantification. To his opinion, in both physical and social sciences, there are areas where explicit articulation is not possible. In physical sciences, this vagueness is especially profound when research is carried out at extreme physical conditions. Hence, to his opinion, the question is not whether a subject matter is more exact than the other, but rather objectivity. "Once a new fact or a new idea has been conjectured, no matter on how intuitive a foundation, it must be capable of objective test and confirmation by anyone." (Ibid.: 27)

e. Objective vs. subjective knowledge

Another distinctions being made between methodology of social and natural research is that the former provide only subjective opinions while the latter is capable of universal and objective[2] knowledge (Nagel, 1961: 473). This is because social phenomena are inherently "subjective" or "value-impregnated". The subject matter of

[2] However, believers of social constructivism despise the idea of objective science (Longino, 1990: 9).

social study is human action, which is driven by motives, beliefs and values. These are matters that are not open to sensory inspection. These are matters that can only be understood through personal experiences which are subjective.

Scientific method is also more objective in another sense. It is a method accepted by community of scientists through consensus (Ziman, 1984: 108). As such, results of any experiment can be analysed by peer group without much difficulty. Indeed, scientists are consciously or unconsciously sharing a single volition and adopting one single objective of scientific research – to discern the truth. Conversely, social science deals with knowledge of "ideas"[3] (Huer, 1990: 20). Ideas (such as love and hate) are symbolic meaning. They can only be clarified by different interpretations of a similar phenomenon. As such, looking for consensus is actually going against the nature of social study (ibid.: 21).

f. The purpose of social research

As social and natural science research are fundamentally incongruous, some researchers have suggested that both fields do not actually sharing the same purpose of research. While natural scientists strive to unravel the "truth" about our natural environment, social scientists may have no "truth" to be unveiled, since there may not have social laws apart from the fact that social reality could have many faces that can be interpreted differently (Huer, 1990: 135-136). Given the nature of social research

[3] As opposed to knowledge of "things" in natural science.

which is value-laden and tends to seek different and even contrasting interpretations, the effort to pursue "accurate" knowledge in social science could be meaningless. Thus, to Huer's opinion, the purpose of social research should be "social relevancy" and not "knowledge accuracy" as pursued by natural scientists. Popper (1972: 342), in his critics of historicism, also suggests that the major task of theoretical social scientists is "to trace the unintended social repercussions of intentional human actions" and not to make the same kind of prediction like physical sciences.

4.7 Future knowledge

From the foregoing discussion, we can see that the application of scientific standard in evaluating the validity of social knowledge may not be appropriate. Social reality is not the same as physical reality. Human beings are unlike physical objects. It is more complex and less predictable.

In foresight research, the situation is even more precarious. Though social knowledge is complex, but at least it is temporal. It has physical existence. We can at least make observations about social realities though we may not be able to achieve a conclusive interpretation. Foresight research, however, deals with *futura* (future facts). Futurists actually strive to know what has not yet materialised. At present, nothing in future has happened that can be known. As such, immediate verification of foresight results is not possible (Bell & Olick, 1989: 115). One can only know whether a foresight is accurate in future, and as we know, a future occurrence may

only be decided by future conditions, which have little or no empirical evidences at present. Future is an area where human cognition has limited accessibility. It is an area of *terra incognito* (Kahn, 1975: 14).

That is why researchers suggest to call future knowledge "posit knowledge"; a tentative knowledge (Ibid.:126), a knowledge that we treat it as correct as long as conditions we assumed do not change. This is in line with the concept of *la prospective* (Godet, 1982) where several alternative futures are presented in foresight analysis.

4.8 Conclusion

The rivalry between science and non-science is a rivalry between the understanding of the physical realm of existence and social realm of existence. The push for the adoption and use of scientific method in every realm of knowledge construction arise out of the confidence of the ability of scientific method in revealing the truth. However, analysis of scientific method itself has revealed that scientific method has also its limitations and scientific knowledge does not represent ultimate truth. Scientific knowledge has been refuted and will continue to be renewed in future.

Besides, it is also not appropriate to force this method of investigation on social studies simply because social reality is a much more complex reality. It is

beyond the ability of scientific method to contemplate. As such, both areas of research may not share the same destiny. While physical sciences aim to unravel the law of physical reality and explain the operation of the physical world, social scientists may not be able to do the same since we can not be sure of the presence of "social laws" given the dynamic nature of social development. In the field of future research, the condition is more precarious. Unlike physical science research, future research does not deal with current reality. Future facts have not materialised. It does not have physical existence. Hence, future knowledge is even more uncertain than certain social knowledge, not to mention knowledge of physical science. In the following chapter, we will illustrate the construction of future knowledge with one of the most popular foresight method – the Delphi method.