An Epistemological Study of Malaysia's Science and Technology Policy

By

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Abstract

This study is an epistemological analysis of Malaysia science and technology (S&T) policy. The study analyses the underlying notions and premises adopted – either deliberately or unconsciously - in the management of science and technology, including research and development (R&D), human resource development (HRD) and information technology (IT) planning. Owing to the complex nature of S&T and the contributions of many traditions in their development, the study focuses on some of the pertinent conceptual meanings of S&T, the relationships between science and technology, the sociology of S&T, and the politics of S&T. One of the initial findings of the study indicated that Malaysia's science and technology (hereafter cited as "science policy") is still in an early developmental stage. This is reflected in the attempts to borrow planning strategies from other countries, including the OECDs to incorporate those strategies in the national science policy. Nevertheless, Malaysia has made substantial innovations in promulgating her version of science policy. Social political and cultural factors are incorporated into the formulation of strategies and policies. This is also reflected in the institutional structure and bodies that are entrusted with the management of S&T. Malaysia aspires to develop, scientifically and technologically, in a holistic mould. The latter implies that S&T are value laden and should be primarily directed to the development of human spiritual and moral ideals, besides the material. At the theoretical level these views are conspicuous and well documented, however at the implementation level the focus is mainly on the conventional view of S&T emphasising primarily technical and pragmatic strategies.

Abstrak

Kajian ini adalah satu analisis epistemologi tentang polisi sains dan teknologi Malaysia. Kajian menganalisa konsep dan premis yang mendasari - sama ada secara dirancang atau tidak - pengurusan sains dan teknologi, termasuklah penyelidikan dan pembangunan, pembangunan sumber manusia dan perancangan teknologi maklumat. Oleh kerana keadaan dan sifat sains dan teknologi yang kompleks yang diadun oleh pelbagai tradisi dalam pemkembangannya, maka kajian ini ditumpukan kepada isu-isu konseptual yang penting dan perlu untuk memahami asas polisi sains dan teknologi. Isu-isu tersebut termasuklah definisi konseptual S&T, hubungkait antara sains dan teknologi, sosiologi S&T, dan politik S&T. Salah satu penemuan awal kajian ini ialah sains dan teknologi polisi di Malaysia masih lagi di peringkat pembangunan awal. Ini terserlah dengan usaha-usaha untuk meminjam strategi dan program dari negara lain termasuk OECD sebagai panduan penggubalan polisi sains negara. Bagaimanapun, Malaysia juga telah melaksanakan inovasi dalam menentukan corak polisi sainsnya. Faktor-faktor sosial, politik dan budaya telah diterapkan dalam formulasi strategi dan polisi sains. Hal ini terserlah dalam struktur institusi-institusi dan badan-badan yang diamanahkan bagi mengurus S&T. Malaysia berhasrat untuk membangunkan sains dan teknologi dalam bentuk yang holistik. Ini diandaikan bahawa S&T adalah soal nilai dan perlu dijuruskan kepada pembangunan kerohanian manusia dan nilai-nilai moral disamping kebendaan. Secara teori, pandangan ini adalah jelas dan termaktub, bagaimanapun, perlaksanaannya masih tertumpu kepada pandangan konvensional S&T yang menekankan strategi teknikal dan pragmatik.

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List of Abbreviations

EPU.....Economic Planning Unit

FOR. .....Field of Research

HRD. .....Human Resource Development

ICDC. .....Integrated Circuit Design Systems

IRPA. .....Intensification of Research in Priority Areas

IT. .....Information Technology

JARING. .....Joint Advanced Research Integrated Network

MARDI. .....Malaysian Agricultural Research and Development Institute

MASTIC. .....Malaysian Science and Technology Information Centre

MDC. .....Multimedia Development Corporation

MIMOS. .....Malaysian Institute of Microelectronics

MIS. .....Management Information System

MITI. .....Ministry of International Trade and Industry

MOE. .....Ministry of Education

MOI. .....Ministry of Information

MOSTE. .....Ministry of Science, Technology and the Environment

MSC. .....Multimedia Super Corridor

NCSRD. .....The National Council for Scientific Research and Development

NITC. .....National Information Technology Council

OECD. .....Organisation for Economic Co-operation and Development

PORIM. .....Palm Oil Research and Development Institute of Malaysia

R&D. ..... Research and Development

SEO. ..... Socio-Economic Objective

SIRIM. ..... Standard Research Institute of Malaysia

UNESCO. ..... United Nations Educational, Scientific, and Cultural Organisation

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Part II

Introduction

In our modern life, science and technology (S&T) have been relegated a position that was once the provision of religion and art. The role of S&T reflect their importance at various levels of societal existence. One could speak of the intellectual level as well as the sociological level. At the intellectual level, as far as modern man is concerned, science has long replaced religion as the arbiter of truth and source of objective knowledge. At another level, as a cultural tool, technology tamed angry fires, fierce rivers, majestic mountains and the terrible storms; all were once divine creatures of the ancients that in the religious era would only listen to the command of God or prayers of the prophet. By science, modern man redefines himself and his earthly destiny; by his technology he manipulates his earth; by integrating S&T, modern man extends the human capacity as never before, elevating himself to the role of the creator of "heaven on earth" - the 'New Atlantis" or "Utopia" - without having to wait for the heaven of the next life. The success of S&T in transforming human life in the last two centuries to a stage unequalled by anything else in the records of human history is self-evident. This manifestation is seen in many industrially advanced societies in the form of socio-economic prosperity and physical well being.

Epistemologically, however, is the question of whether the prevailing science as the only possible way of conceiving and knowing natural phenomena, i.e. the only way of doing science. Whether the way technology is currently understood and used in exploiting nature has been the only efficient profitable way for mankind. A recourse to history will provide us with some clues to the answer. We now know that in the history of civilisations, nature has been subjected to different forms of interpretation, reflecting the diversity of human beliefs and perceptions. On one hand, nature may be sacred in a civilisation so will the science be. On the other, nature may be seen by a civilisation as a profane entity having no more than a material content, and this will be equally reflected in its science. In short, the conception of science in one civilisation may thus differ from another. Modern science as we know it today is basically nurtured and developed within the western civilisational context. Arguably then it is one possible way of doing science. This even leads to the possibility that in a given civilisational context that there can be different approaches to the study and applications of S&T.

How the primordial science came to being, is open to many speculations. Human inquisitiveness and desire to understand the natural phenomena around him could be a cause. Early man wanted to know how the earth, the sun and the elements moved about in the sky. Eventually, intellectual activities (although far from what is termed today as scientific) of interrogating nature, fundamentally involving observation and rational explanation, were developed into a systematic technique. This effort was first documented in place called Ionia. It was in Greece, at the time

associated with the teachings of Plato and Aristotle, that those intellectual activities and techniques subsumed under the collective term "natural philosophy" first took place. Much later, the "natural philosophical inquiry" grew to become into a "scientific inquiry" aims primarily at explaining the changes occurring in the every day natural phenomena through empirical observation and rational theories.

It was during the medieval period, that a notable change took place in human perception of natural phenomena. This was a period when some of the major philosophical thoughts on nature from the major civilisations of the time - Islam, Christianity and Greeks - were conceptualised or re-conceptualised. The cross-fertilisation of thoughts between the major civilisations gave nature and its method of inquiry a new meaning and a new direction. It was also in this period that the idea of science was expanded and its methods were elaborated in the context of the prevailing epistemological principles. One of these was the concept of the hierarchy of knowledge. In addition to that the scope of science was broadened to include practical principles not mentioned by earlier scholars like that of the Greeks.

Perhaps one of the most important developments that took place in the period was the recognition of technology as a legitimate branch of science. The novel achievement was first noted among the Muslim philosopher scientists. It was an achievement because such recognition come about in the midst of successive epistemologies - both of the East and the West - that emphasised the separation of science from technology. Indeed, technology was demoted to the lowest form of knowledge befitting the lowest class of the society. At most, technology was ranked

as an art: knowledge for the artisans. The Muslims rehabilitated technology to a respectable intellectual enterprise and by doing that they had established an epistemological tradition that sets the foundation for the eventual marriage of science and technology. The essence of the foundation was the emphasis on combining the theory and practice of scientific knowledge.

When the theory and practice of science is considered inseparable, a floodgate of new ideas was released, overwhelming the prevailing conception of nature. A few of these ideas coalesced and they eventually led to the fermentation of a different view of nature. The intellectual fermentation was evident during the golden age of Islamic learning, a period that spanned and coincided with the so-called Dark ages of Europe and the early Renaissance period. With the decline of the Islamic intellectual tradition the scientific baton was passed to the Europeans. The latter continued the intellectual run but eventually headed into a totally different direction from it predecessors. The new direction was manifested in a conception of nature that was particularly evident in Europe during the age of the Enlightenment. The most notable was the celebration of the secularistic and mechanical worldview of the universe. The secular worldview refused to acknowledge any role for the Divine and the sacred beings in nature; the mechanical worldview is fundamentally a material and quantitative world; a world associated with mathematical precision and predictability. The language spoken in that world is mathematical language - not the symbolic version of the language but syntactic one - and it follows that one who speaks and asks questions in the mathematical form will get all the formal answers.

Effective scientific inquiry then came to be associated only with the method that emphasises the use of formal mathematics in the study of nature.

The use of mathematics in trying to understand nature and the belief that looking for mathematical regularities could lead to a deeper insight and understanding of nature, have long been intellectually associated with Platonic doctrine of the Greeks or the neo-Platonists of the Muslims. Indeed, much earlier, the ancient Greek scholars especially those belonging to the Pythagorean School subscribed to the belief that the essence of nature was written in the language of mathematics. However, the Pythagorean mathematics was based on two fundamental principles: transcendental symbolism and metaphysics. These ideas are almost forgotten and incomprehensible in modern quantitative mathematics. Why this was so, is beyond our discussion here. Suffice is for us to note that the development of mathematics during the Enlightenment period was marked by the aggressive adoption of quantitative and syntactic doctrines at the expense of the of qualitative and semantics. So much so that by the turn of the nineteenth century there was no longer any room for the idea of "mathematical beauty", this was especially so when "mathematical exactness" was the only virtue in the world of mathematics. Inevitably it led to the creation of selective approaches in which even a quality should be reduced into a quantity so that it could be measurable. When this notion of mathematics became the central instrument in the inquiry of nature, it sets the stage for the emergence of the modern scientific method.

If mathematics can be explained as the handmaiden of scientific method then empiricism is the handyman. Indeed the scientific method is supported by two major foundations: mathematics and the empirical method. The foundations also define the popular character of the modern scientific method that is based on the methods of observation and experimentation.

However, the method of modern scientific knowledge that emphasises observation and experimentation go hand and hand with only a particular view of nature: a physical and quantitative one. In contrasts, nature in the earlier civilisations, and indeed in many current Asian societies, has been seen as having a richer character: full of symbolism and spirits. To many traditional societies, nature was a symbol, a bridge to a transcendental reality; nature has a physical as well as a metaphysical essence, thus nature should be understood qualitatively as much as quantitatively. And indeed this character of science preserves the image of science that was prevalent in the Islamic and medieval period. Medieval scientific activities were conducted with the view that nature possesses a metaphysical dimension, and that the non-empirical methods played major roles in the inquiry of natural phenomena. In contemporary modern science, however, these dimensions were excluded and the empirical became the only source of knowledge of natural phenomena.

Such emphasis by the new scientific knowledge and practices widened the gap between science and metaphysical knowledge of nature. While it used to be that the former and latter nurture each other, now each seems to be an anti-thesis of the other.

Indeed, the relation between the former and the latter has become one of the central concerns of epistemologists, and philosophers of science, including practising scientists and critics of science. They have articulated a number of viewpoints on what characterised a perfect science or scientific method. One notable school of thought was the logical positivism that advanced the positivist image of science. The school emphasised the separation of science from its philosophical roots and accepted mathematics to be the only legitimate form of reliable knowledge. In fact, they see the role of mathematics as essentially establishing the connections between mathematical and physical signs that can be ultimately discerned by the empirical senses via scientific instruments. The separation of science from philosophy and the denial of the metaphysical dimension of science gave the rise to materialistic conception of science. This science saw the phenomena of nature as essentially dead entities. It is thus inevitable and easy from this point of view to hold the doctrine that the scientific and technological practice should be conducted free from any kind of ethical and moral obligation. In short, S&T should be value-free and culturally neutral.

This view of science gives freedom for scientists to conduct research activities in scientific fields and to direct them towards their desired goals. These goals were not necessary noble by any standard. The development of destructive weapons, including nuclear, chemical and biological is perhaps a testimony of how pernicious S&T can be if divorced from its noble goals, particularly from ethics and axiology. Equally a science that retains its noble goals, the quest for the truth, and the search for

answering perennial questions about life and universe could be channelled for the ultimate betterment of human life. Prerequisite to enable this is a science that re-establishes its links with its axiological and philosophical roots. These links can only be established within a pool of knowledge that includes not only the mechanics of managing, and formulating an S&T policy but also a knowledge of what the essence of S&T were and what they have become, and what their future potentials are.

Contemporary science and technology policy studies have concerned themselves exclusively with the proper management of funds allocated for S&T, the management of manpower requirements and the management of R&D. While these are important issues, they should not diminish the importance dealing with fundamental intellectual issues associated with S&T policy studies. These issues include the kind of paradigm of S&T adopted by a society, the axiological or value systems embedded in the adopted S&T, and the impact of the S&T on the indigenous worldview (*Weltanschauung*) and cosmology.

This study is an attempt to integrate an S&T policy study that discusses the management of S&T, R&D management and the politics of S&T within the framework of an epistemological analysis that includes all the issues mentioned earlier. This study takes an analytical look at: (i) the management of S&T that includes the formulation of guidelines for the implementation and application of S&T for industrial or social development; (ii) the management of R&D, that includes the funding, prioritisation, invention and commercialisation of technologies and know-how resulted from the R&D; and (iii) the politics of S&T, the rationale and social

manoeuvres of guiding and directing the development of S&T for political and social stability, development both at local and international level.

The conceptual parameters above are realised by focusing on a case study of Malaysia's Science and Technology Policy. The study essentially focuses on the analysis of the underlying epistemological premises of the management, planning, and application of S&T in Malaysia. The study is divided into two major parts. Part I focuses on the philosophical, historical and sociological background of S&T. The main purpose of part I is to provide the conceptual settings for the following discussions in part two. Part I is sub-divided into two chapters; chapter one discusses the epistemological and historical background of S&T. Chapter two discusses the impact of S&T on society, the politics of science and the parameters of science policy.

Part II is an attempt to critically analyse the development of S&T policy of Malaysia within the conceptual parameters outlined above. The analysis is discussed in four chapters. Chapter three gives a critical overview of the role and importance of S&T in the socio-economic development and planning in Malaysia. Chapter four and five discusses R&D and human resource development respectively. Chapter six discusses one of the most important agenda of Malaysia's S&T policy in last decade of the 90s: the information technology policy of Malaysia. A qualifying statement is probably in order here: This study does not claim to be an exhaustive one. However, it does claim as a prolegomena to an epistemological study of the S&T of Malaysia.