

## Rhetoric of Innovation Policymaking in Hong Kong Using the Innovation Systems Conceptual Approach

Naubahar Sharif \*

\* *Division of Social Science, The Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong SAR*

---

### Abstract

Since its introduction in the 1980s, use of the innovation systems (IS) conceptual approach has been growing, particularly on the part of national governments including, recently, the Hong Kong Government: In 2004, the Hong Kong Government set forth a 'new strategy' for innovation and technology policymaking. Because it marked a significant break from the past (characterized by a *laissez-faire* Government attitude), it was necessary to convince a wider audience to accept this new strategy, a strategy which included the IS conceptual approach. Adopting a science and technology studies (S&TS) perspective, I show how the IS conceptual approach is being used as a rhetorical resource by the Hong Kong Government in its innovation and technology policymaking in an effort to persuade its perceived audience of the efficacy of its new strategy for its policies—policies that are in fact unrelated to the basic precepts of the IS conceptual approach. The case provides a cautionary tale in the ways in which policymakers transform scholarly work and scientific discovery into rhetorical instruments in support of a political agenda.

*Keywords:* Innovation Systems; Policymaking; Hong Kong; Rhetoric

---

\* Tel.: +852 2358 7826; Fax: +852 2335 0014; Email: [sosn@ust.hk](mailto:sosn@ust.hk)

# RHETORIC OF INNOVATION POLICYMAKING IN HONG KONG USING THE INNOVATION SYSTEMS CONCEPTUAL APPROACH

---

## 1. Introduction

Innovative activity in any organization often depends heavily on external resources. It is therefore appropriate to characterize successful innovation as a 'collective achievement.' The study of innovation phenomena has therefore involved the delineation of 'innovation systems' in order to capture this 'collective' aspect for analysis. The innovation-related factors that belong to such a 'collective' or 'system' include institutions (laws, regulations, rules, habits, etc.), the political process, the public research infrastructure (universities, research institutes, support from public sources, etc.), financial institutions, skills (the labor force), and so forth. Scholars in several areas of social science have developed a set of concepts with which to study innovation systems, and the general conceptual approach that has evolved in this effort has gradually spread from the academy to policymaking circles over the past two decades.

The innovation systems (IS) conceptual approach thus provides a tool for analyzing, *inter alia*, country-specific features of the innovation process and guiding policy formulation.<sup>1</sup> It highlights interactions among various actors by locating their work within a holistic system rather than focusing on the

---

<sup>1</sup> Fagerberg (2005: 13) contends that systems typically exhibit more 'structure' than a network, and are of a more enduring character. Furthermore, a dynamic system also has feedback mechanisms, which may serve to reinforce—or weaken—the existing structure/functioning of the system.

performance of individual components (Lundvall 1992). The Organisation for Economic Cooperation and Development (OECD), a major proponent of the IS approach, defines an innovation system as a “set of institutions that (jointly and individually) contribute to the development and diffusion of new technologies . . . [providing a] . . . framework within which governments form and implement policies to influence the innovation process” (Metcalfe 1995 in OECD 1999: 24).

The IS conceptual approach is, however, more than a merely descriptive tool with which to identify institutions and organizations that contribute to the development and diffusion of new technologies. To fully understand an innovation system, therefore, it is not sufficient simply to enumerate its constituent elements—that is but the first step. Rather, the IS conceptual approach is also a focusing device with which to analyze the development, diffusion, and use of innovations by measuring, quantitatively and qualitatively, the intensity and nature of linkages among the factors that influence successful innovation. Interactions among diverse organizations operating in distinct institutional contexts—especially when they facilitate knowledge flows—affect the innovation process. By focusing on such linkages between organizations, institutions, and other factors that influence innovations, the IS conceptual approach can be used to identify deficiencies in an innovation system and prescribe corrective measures. That is, the IS conceptual approach has both descriptive and normative dimensions. In promoting technological innovation as a goal, the IS conceptual approach, taking an industrialized economy as its model, prescribes correctives based on comparisons of both innovation activity between economies that exhibit

similar levels of innovative and economic development and linkages within a given innovation system.

The IS approach has since the 1990s exerted considerable influence in the government domain, as many public administrations have shifted their focus from science and technology policies to innovation-specific policies. These include the OECD (1996, 1997, and 1999); the European Commission, (1996, 2002); the 'Systems of Innovation Authority' (known as VINNOVA) in Sweden; the National Technology Agency of Finland (2002); the Government of Canada (2002); the Government of New Zealand (2002); and the UK Office of Science and Technology (2002). In 2004, the Innovation and Technology Commission (ITC) of the Hong Kong Special Administrative Region Government (hereafter 'Government'—with a capital 'G') also adopted the IS conceptual approach as a central organizing paradigm for its innovation and technology program.

In this paper, I present the Hong Kong Government's embrace of the IS approach as a case study in its application.<sup>2</sup> While it is common to think of science and technology policy documents as flat, unemotional, and unequivocal (see, for example, OECD 1999; European Commission 2002), by adopting a science and technology studies (S&TS) perspective I show how the innovation systems approach is used currently by the Hong Kong Government in its innovation and technology policymaking as a rhetorical device for purposes that are not directly related to the conceptual precepts that its proponents cite in promoting it as an economic development tool. Instead of establishing policies that incorporate principal elements of the IS

---

<sup>2</sup> All references to 'Hong Kong' in this paper refer in full to the 'Hong Kong Special Administrative Region of the People's Republic of China'.

approach into their content, Hong Kong has traded on the growing prestige of the approach to enhance the perception that its development policies leverage the latest trends in academic research. Understanding how Hong Kong's government has thus transformed conceptual advances in scholarly research into a rhetorically strategic adjunct of a technology policy that incorporates little of the actual content of the IS approach should shed light on broader issues involved in the dissemination for public benefit of scholarly research and scientific discoveries.

## **2. The Study of Innovation Systems in Science and Technology Studies (S&TS): What We Do and Do Not Know**

In this paper I explore a rarely discussed issue in addressing the rhetoric of the innovation systems conceptual approach in the policymaking domain. There is, however, some S&TS scholarship that examines the use of rhetoric in policymaking across a broader spectrum of approaches—not necessarily related to the innovation systems conceptual approach. This literature includes: Kraemer et al. (1987), who offer an excellent description of the social processes through which techniques of computer-based econometric planning models have been implemented in the U.S. federal government, and how the use of these large-scale econometric models have influenced policy debates; Kivinen and Varelius (2003), who explore the rhetoric used in Silicon Valley in the implementation of biotech technology policy that is organized according to the 'Triple Helix' model; Hellström and Jacob (2005), who analyze narratives surrounding the social relevance of science in order to

examine the discourses policymakers employ in promoting university-industry collaboration in Sweden; and Stenekes et al. (2006), who, in studying public acceptance of water-recycling technology, suggest that rhetoric is counterproductive to policymakers' objectives. Tuunainen (2005), Halfon (2006), and Irwin (2006) also discuss the use of rhetoric in policymaking and scientific governance as it pertains to universities, population policy, and the public arena at large. The most noteworthy example of this type of general S&TS scholarship is, however, the research of Godin (2005a, 2005b and 2006), who has conducted extensive work on the history of science and policy statistics, focusing on the social construction of such statistics (including such seminal OECD publications as the Frascati Manual, OECD 1994, and the Oslo Manual, OECD 1997b) as well as the linear model of innovation.

This paper adds to a small body of literature that examines the use of the IS conceptual approach in policy circles. Among the more prominent such works are those of Mytelka and Smith (2002) and other articles in a special issue of *Research Policy* (volume 31, issue 2, 2002), and chapters in Larédo and Mustar (2001). Here I view interviews and document analysis through an S&TS lens against the backdrop of Hong Kong's newly industrializing economy, which provides a unique opportunity to study the IS approach in the context of a small economy that is repositioning itself to join the global knowledge marketplace while leveraging its relationship with the world's fastest-growing economy in Mainland China.

Considering more specifically recent S&TS research that has focused on the IS conceptual approach, I cite Miettinen (2002), Sharif (2006a), and Albert and Laberge (2007) as leading examples. Focusing on the national

rather than the international or regional levels, Miettinen focuses on the political rhetoric surrounding the IS approach in the development and implementation of the *National Innovation Systems* (NIS) conceptual approach in Finland in the 1990s. In particular, Miettinen analyzes the ways in which innovation research influences the adoption of specific policymaking language on the part of international and national policy actors. This examination of the rhetoric of the discourse employed in research-to-policymaking transactions shows that the NIS conceptual approach is now well established in the language of technology and innovation policy in Finland. Miettinen doubts, however, that the NIS approach can serve as the sole basis of technology policymaking.

Sharif (2006a) adopts an S&TS perspective—seen through a social constructivist lens—to analyze the development of the NIS concept as a social technology. Sharif examines the production, development, diffusion, and use of the formal body of codified NIS knowledge, identifying the key social groups or ‘epistemic communities’ responsible for developing the NIS concept, revealing the motivations that have driven the NIS concept’s development within these communities.

Albert and Laberge (2007) apply an ethnographic approach to illuminate processes of legitimation and dissemination that pertain to innovation systems in examining international and regional policymaking, with particular attention to the OECD and the government of Québec, Canada. Their results, obtained by combining participant-observation techniques with semi-structured interviews, focus on, among other things, the effects of socio-cultural processes on the adoption of the IS conceptual approach by

government officials in Québec. They find that instead of basing their adoption of the approach on comparative analysis of available models, these officials were persuaded by the academic credentials of those who developed it, which in their view have conferred on it a mantle of scientific prestige that legitimizes its use in the policymaking process.

This paper's analysis of the innovation system in Hong Kong is among the first in either S&TS generally or more narrowly in innovation studies to follow the IS conceptual approach beyond its European origins (see also Baark & Sharif 2006; for a study that brings a Triple Helix Model to bear on Hong Kong, see Parayil & Sreekumar 2004).<sup>3</sup> Indeed, the first official use of the innovation systems terminology in Hong Kong by the Hong Kong Government occurred only in the summer of 2004—a launch that represents a noteworthy point of departure from which policymaking may develop in interesting ways.

By studying the application of the IS conceptual approach in Hong Kong, this paper contributes new ideas to both the S&TS and the innovation studies literature. I add to the S&TS literature by analyzing the rhetoric of the IS conceptual approach in policy formulation. In innovation studies, I note growing interest in learning about innovation systems on the part of 'catching-up' or newly industrializing countries in East Asia and South America (characterized by recent international conferences on 'Innovation Systems' held in Rio de Janeiro in 2003, Beijing in 2004, South Africa in 2005, and India

---

<sup>3</sup> On a theoretical level, see Jasanoff 2004 on the co-production of knowledge and policy for an example of scholarship on the use of knowledge in policy. Prior to Jasanoff's work on co-production, Guston (2000, especially pp.37-63) helped improve our understanding of the technology policymaking process significantly by discussing the origins and evolving nature of state involvement in science.



in 2006).<sup>4</sup> My focus on Hong Kong contributes to this growing body of work as it represents an under-studied class of countries that scholars increasingly wish to understand through the lens of the IS conceptual approach.<sup>5</sup>

### **3. Methods**

In investigating the use of the innovation systems conceptual approach in Hong Kong I interviewed actors who produced the recommendations to the Government on its recent innovation and technology policymaking. In order to achieve as complete a picture as possible of innovation and technology policymaking in Hong Kong I identified and interviewed individuals across a broad spectrum of institutions and job titles.<sup>6</sup>

In the course of this process I interviewed 15 individuals in 2004 and 2006 (see the Methodological Appendix for detailed information about the respondents). It should be noted that my interviewees requested anonymity, so I do not offer verbatim quotes even where quotation marks enclose statements derived from interviews. Such quoted passages—and any other ideas attributed to interviewees—paraphrase what were, in effect, off-the-record remarks. My respondents requested anonymity, motivated by two chief concerns. First, there is traditionally in Hong Kong culture a tacit

---

<sup>4</sup> These conferences were sponsored by the 'Global Network for Economics of Learning, Innovation, and Competence Building Systems' initiative, or GLOBELICS.

<sup>5</sup> For recently published academic work on this subject see, for example, chapters in Lundvall, Intarakumnerd & Vang (2006) and Edquist & Hoemmen (2008).

<sup>6</sup> These included: technology policy advisors to the Government who have offered technology policy recommendations, based on which the Government has implemented innovation and technology policy; academics who have utilized the innovation systems conceptual approach to study Hong Kong's innovation system; consultants who have worked for the Hong Kong Government; Hong Kong Government bureaucrats who formulate or implement technology and innovation policy; and executives of the recently established research and development (R&D) centers.

understanding (reflecting a Confucian orientation) that consensus-building requires the support of a strong-willed leader. In some cases the individuals whom I interviewed may have opted for discretion out of deference to such a leader.<sup>7</sup> Secondly, respondents who serve the Government as advisors or consultants understand that such advisory roles bring with them a certain prestige, often opening the door to more lucrative or influential positions as a result of providing counsel on policymaking initiatives. Discretion is the understandable choice in this case as well, as an impolitic remark might jeopardize such an opportunity. In either case anonymity allowed for more candid responses on the part of the respondents than they would have provided had they been named.

In addition to interviewing key actors in the policymaking arena, I also systematically examined the literature related to Hong Kong's innovation system. Because so little work under the banner of 'innovation systems' pertaining to Hong Kong and its economic structure exists, I had to research and recover a body of material from other fields including, most notably, business studies and Hong Kong politics. I also reviewed official Government policy documentation, ranging from publicity leaflets and consultation papers to transcribed versions of the Chief Executive's policy addresses from 1997 to 2004.

---

<sup>7</sup> In this case, the individual who appears to have played this role is Professor Chang-Lin Tien, the chair of the Hong Kong Commission on Innovation and Technology (the CIT—see section 4, below, for more information on this body), and as a result of the authority given to him in this capacity he was able to forge a consensus about how Hong Kong should approach innovation and technology, imprinting the CIT's findings with his own stamp, from emphasizing basic research to inculcating a linear model of innovation.

#### **4. Hong Kong as a Case Study in the Application of the Innovation Systems (IS) Conceptual Approach**

In 1997 two major developments converged to alter Hong Kong's political economy. As of 1 July, the People's Republic of China assumed sovereignty over the territory. Only weeks later, the shock of the Asian Financial Crisis plunged Hong Kong's economy into its worst ever recession. To cope with the resulting upheaval, Hong Kong's Government began to work actively and urgently to overhaul the economic and innovation systems so that Hong Kong could assume a new role in global markets and build a new engine of growth that would be sufficiently robust to pull the economy out of its slump.

In his inaugural policy address to the public on 8 October 1997, the Chief Executive of Hong Kong, Tung Chee-Hwa, said, "My aim is to make Hong Kong an innovation centre. We . . . need to do more to stimulate the exchange of ideas between our university researchers, our businessmen and industrialists, and our customers, so as to drive forward innovation and turn technological development into commercial products . . . I shall be setting up a high-level committee of academics, industrialists, businessmen, and officials to advise me on what steps Hong Kong should take, and what institutional arrangements are needed to achieve my aim" (Tung 1997).

Tung's high-level advisory committee of academics, industrialists, businessmen, and officials took shape as the Commission on Innovation and Technology (CIT) in March 1998. In its first report (1998) the CIT, in response to the challenges that Hong Kong was facing at the time, outlined a vision statement, declaring that "innovation and technology are vital to the future

prosperity of Hong Kong” (HKSAR 1998: 13). Believing that “there is a weak R&D culture in industry” (HKSAR 1999), the CIT based its vision of Hong Kong’s new role explicitly on science, technology, and innovation. The Commission’s second and final report (1999) made eight concrete recommendations that identified measures to promote high technology innovation in order to lift Hong Kong out of its deep recession. They were: (1) coordinating the Government’s policy functions; (2) merging the Science Park, the Industrial Estates Corporation, and the Industrial Technology Center; (3) investment in education; (4) bringing overseas talent to Hong Kong; (5) relaxing immigration restrictions on talent from the Mainland; (6) expanding the Government’s incubator program; (7) encouraging closer ties between academia and industry; and (8) exploring the feasibility of a co-investment scheme to provide Government venture capital on a matching basis with private funds (HKSAR 1999: 5-7).

Given these specific 1999 recommendations and a general climate encouraging innovation and technology from 1997 onwards (Sharif 2006b), Hong Kong was perfectly positioned to utilize the IS conceptual approach. The IS approach could have served as a focusing device with which to identify the economic, social, political, and organizational institutions that influence innovations as well as to assess the intensity and nature of their linkages. The first of the CIT’s recommendations corresponds entirely, for example, with the way in which the IS conceptual approach highlights interactions among various actors within a holistic system rather than concentrating on the performance of individual components (Lundvall 1992). Additionally, as the Hong Kong Government was seeking an effective way to intervene in the

economic landscape, the IS conceptual approach could have helped the Government determine how to facilitate innovation-led growth most effectively. The IS conceptual approach identifies deficiencies in an innovation system and prescribes correctives—precisely what the Hong Kong Government was seeking to achieve—as well as advocating for the development of linkages among its components.

#### *4.1 Application of the IS Conceptual Approach in Innovation and Technology Policymaking in Hong Kong*

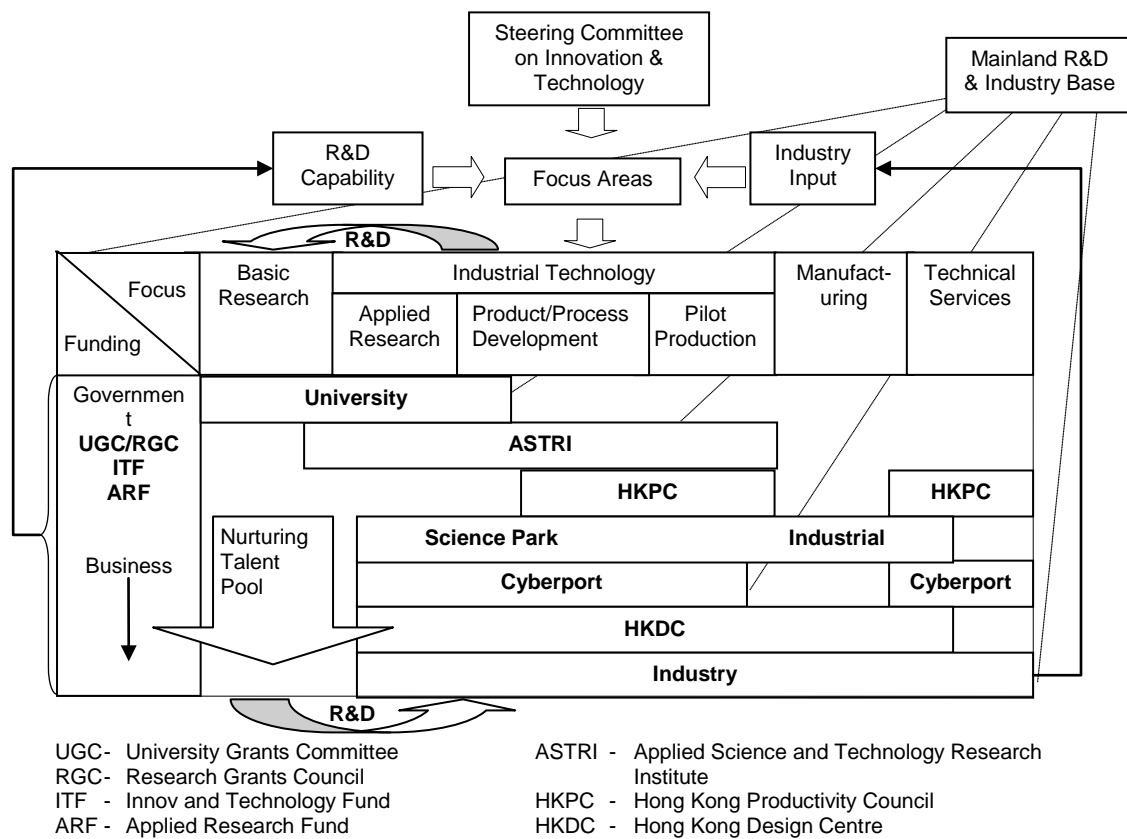
Although there is no explicit mention of the IS conceptual approach in either of the Commission's two seminal reports (HKSAR 1998, 1999), it was referenced later in a Consultation Paper released by an Innovation and Technology Commission (ITC) Steering Committee on Innovation and Technology in June 2004 in which the Government sought to revamp the existing innovation and technology program with a new strategy. In this 2004 Consultation Paper, the term 'innovation system' is used for the first time in official, publicly available Governmental documentation (it was conspicuous by its absence from the CIT's reports of 1998 and 1999; see HKSAR 1998, 1999). In Chapter Three of the Consultation Paper, entitled a 'New Strategy of Innovation and Technology Development,' a short paragraph appears under the heading of '**Innovation System**' (bold in original; HKSAR 2004: 15-18). The short chapter ends with an 'Innovation System' section. It states:

Under the new strategic framework, it is hoped that various elements of the innovation and technology program could work closely together to generate greater impact along the R&D value

chain from basic research to commercialization and production. [The] figure below illustrates the innovation system . . . under the new strategy (HKSAR 2004: 17).

This is the sole mention of the IS conceptual approach anywhere in the 2004 Consultation Paper although, significantly, a diagram of the Government's vision of the structure of Hong Kong's innovation system is also offered in that paper and is reproduced in Figure 1, below.

**Figure 1:** "Figure 3.1: Innovation System under the New Strategy"<sup>8</sup>



Source: HKSAR, Innovation and Technology Commission 2004: 18.

The diagram enables me to analyze the way in which Hong Kong uses the IS conceptual approach in innovation and technology policymaking on two

<sup>8</sup> Title from original.

levels: in terms of the visual representation itself, and also in terms of the ‘work’ the diagram does in the hands of the policymakers. Considering the innovation system diagram above, several key questions arise. Perhaps the most striking thing about it is its failure to accurately emphasize the role of firms. This is especially noteworthy in Hong Kong’s case because of the central role that small and medium sized enterprises (SMEs) play in Hong Kong’s corporate landscape.<sup>9</sup> For example, locating the “Industry” bar (presumably denoting firms) at the bottom of the figure suggests that firms primarily receive innovation inputs while playing a very small role—denoted by the slender arrow on the right that points back to the vaguely designated ‘Focus areas’ box—in generating innovations. This contrasts sharply, as we will see presently, with the central role assigned to firms in the IS diagram from the OECD (1999: 23; reproduced as Figure 2, below), in which firms are positioned at the heart of an innovation system schema. By providing so little information about the makeup of the firms in the “Industry” bar, the diagram sheds no light on one of the key problems that Hong Kong must overcome in order to adapt its innovation system to contemporary economic conditions, namely that its SMEs have traditionally adopted rather than generated innovations, mainly because so few of them are willing to invest in technological research, which they consider to be a high-risk activity.

We can give some credit to the ITC’s visualization for containing many recently introduced elements of Hong Kong’s innovation system, such as the Applied Science and Technology Research Institute (ASTRI), Science Park, and Cyberport (emphasized through the location of the bars), through which it

---

<sup>9</sup> In September 2004, there were about 282,000 SMEs in Hong Kong, accounting for over 98% of total establishments.

spotlights recently (1998 – 2003) introduced measures. At the same time, however, the questions raised above indicate a degree of abstraction that renders the diagram virtually incomprehensible as a guide to enlightened innovation policymaking. It is far from clear, given the absence of accompanying explanation—a mere two sentences—how much meaning the diagram conveys in terms of what is happening (or will happen) “under the new strategy.” In particular, the Hong Kong diagram appears early on in the Consultation Paper (on page 18 of the 83-page document), appearing within the report once only and not again, either in the same section or anywhere else; and there is no reference to any other visualization of Hong Kong’s representation or to any generic IS diagrams, such as the abovementioned diagram of the OECD.

With these similarities in mind, I can analyze the ‘work’ the diagram in the Hong Kong case is doing on behalf of the ITC’s new strategy. The key initiative of this new strategy, and the fundamental way in which it differs from the old, is its emphasis on identifying technology focus areas for future development to be supported by the Government. The idea behind this is to ensure that Hong Kong concentrates its resources on target areas in which it has comparative advantages that offer the greatest potential for meeting Hong Kong’s industry and market needs.<sup>10</sup> Such a strategy represents a significant departure from the Government’s traditional *laissez-faire* operating principle of ‘positive non-intervention,’ according to which the Government’s role is to support market opportunities for entrepreneurs by building infrastructure and

---

<sup>10</sup> These focus areas include: (1) Chinese medicine, (2) communication technologies, (3) consumer electronics, (4) integrated circuit design, (5) opto-electronics, (6) automotive parts and accessory systems, (7) textiles and clothing, (8) nanotechnology, and (9) technologies to enable logistics and supply chain management.



otherwise leave market forces to work in a minimally regulated environment. Furthermore, there is no indication in the diagram of the extent to which Hong Kong's industries' needs are met by its universities' research capabilities. Universities have traditionally linked up with industry by supplying highly trained graduates in science and engineering, effecting technology transfer, and collaborating on research projects. While an analysis of projects undertaken by the Innovation and Technology Fund (ITF) reveals some activity in terms of university and industry collaboration, tangible outcomes such as patents with wide application have not materialized to the extent needed.

Within the context of Government's innovation strategy, the diagram in figure 1 functions as a resource or, in Latour's (1987) terms, an ally, brought to bear on the issue at hand. Just as citations provide one source of allies in a scientific document, diagrams too can be deployed as allies. A diagram—of an increasingly popular policymaking conceptual approach as it pertains to Hong Kong—that is presented without modality suggests that the IS conceptual approach is in line with the Government's new strategy. Or, in other words, the diagram is the Government's way of indicating that the IS conceptual approach helps to justify its proposals, providing what there is in the way of evidence to support the Consultation Paper's claims.

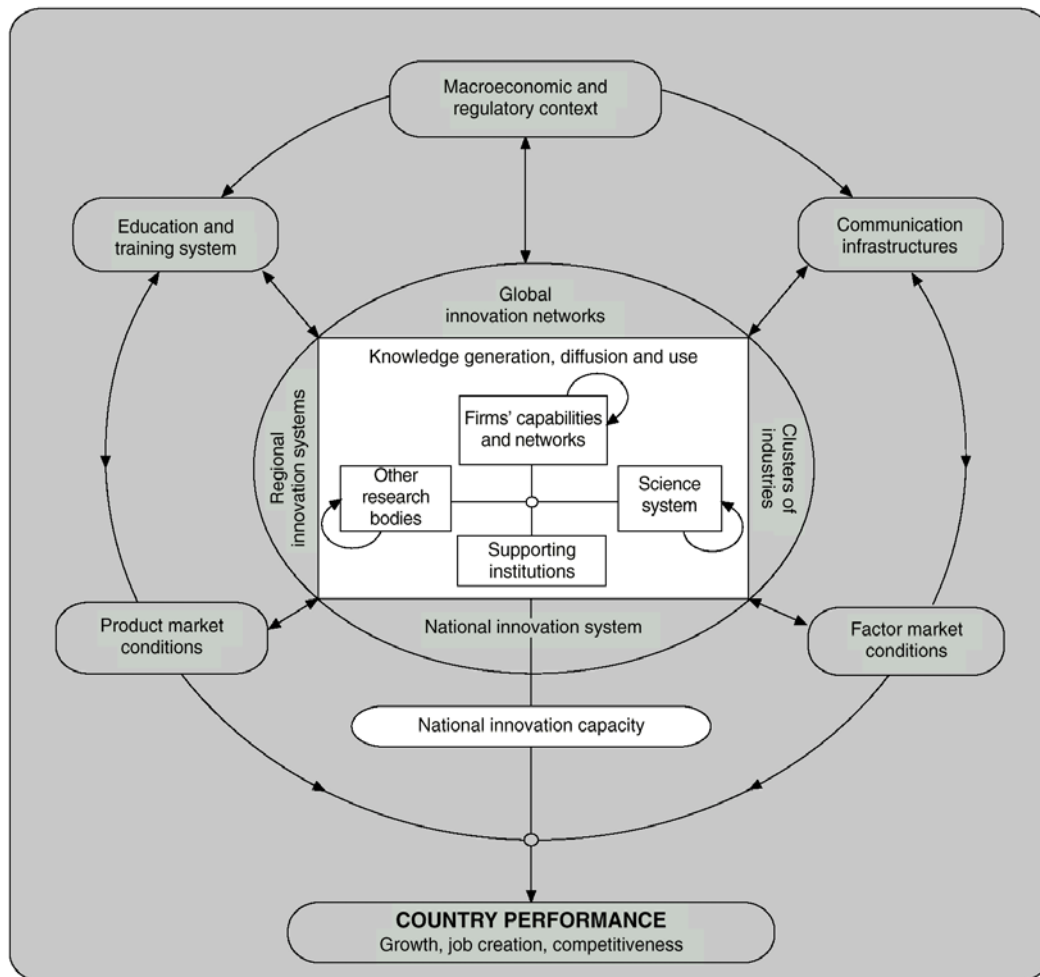
Furthermore, because the IS conceptual approach (insofar as it is represented by the diagram) is not used to guide policy formulation or to suggest alternatives, it appears that the Government is avoiding or unaware of a normative usage of the IS conceptual approach, which is an integral part of its content. A paraphrase of a statement Interviewee #3 made in discussing

the notion of Hong Kong's innovation system confirms this view: "Here in Hong Kong, the innovation system has two major players: universities and industry. These two components form the backbone of the innovation system, and it is possible to see what they do, how they perform. Their actions are measurable" (paraphrase of interview conducted on 23 Jul 04). Similarly, Interviewee #5 said that Hong Kong's innovation system differs from that of China, Taiwan, and those of any of its other neighbors. So, according to this Government official, when the Government thinks about policies that are relevant to Hong Kong's situation, it should bear Hong Kong's unique characteristics in mind, and not necessarily mimic what other countries are doing (interview conducted on 31 Jul 04). In neither of these responses do we find any indication of the normative dimension of the IS conceptual approach; it is used instead in a very loosely descriptive manner to enumerate the innovation-related institutions and organizations present in Hong Kong (or at least those that my interviewees see as being the most important). Based on the manner in which my interviewees discuss 'innovation system' terminology, I conclude that they have in mind only one of the two dimensions of the IS conceptual approach, namely the descriptive dimension, which may help to set up Hong Kong's innovation system as an object for analysis while leaving any such analysis—let alone any subsequent policy prescriptions—undone.

To better indicate how the Consultation Paper diagram departs from the conceptual basis of the IS conceptual approach, I present the diagram to which I have referred that has been produced by the OECD (figure 2). Here we see not only that firms assume a position in the center of the diagram as key actors in 'Knowledge generation, diffusion and use,' but also that all

components of the system are represented as interacting, either directly or indirectly, with all other actors. Here the ultimate goal of innovation is to improve overall economic performance at the national level, and we find firms represented on equal footing with research and logistical resources rather than as passive recipients of such resources. Perhaps most importantly, the arrow that points to 'Country Performance' at the foot of the diagram indicates the normative dimension of the IS conceptual approach. That is, this diagram could serve as a guide to an innovation system analysis the end result of which would be policy prescriptions designed to elevate country-level economic performance and thereby raise a given country's development status. Even though the ITC's ultimate goal is improved economic performance for Hong Kong, its diagram provides no indication that the innovation system, as depicted therein, can be leveraged for the same purpose.

**Figure 2:** OECD Representation of an Innovation System



Source: OECD. (1999). *Managing national innovation systems*. Paris: Organisation for Economic Co-operation and Development, p.23.

#### 4.1.1 Selective Deployment of the IS Conceptual Approach

To understand the rhetoric of the Government diagram as it is presented in the Consultation Paper, we need to understand what the ITC hopes to accomplish by including it in that document. Here I am using the term 'rhetoric' to refer to the manner in which a communicative action or object (in this case the ITC's Consultation Paper and its innovation system diagram in particular) serves to produce an intended effect on a target audience (in this case all the actors in Hong Kong's economy along with the public). To be

sure, two things are happening here: On the one hand, only a part of the IS conceptual approach is being used by policymakers. On the other hand, however, the part that is being used is being used only very broadly as a labeling mechanism, without describing the system in its entirety (for example, the diagram identifies only a few of the constituent institutions of Hong Kong's innovation system, and fails almost entirely to reflect the qualitative nature of the linkages among them).

In terms of the 2004 Consultation Paper, the IS conceptual approach and diagram appear in the chapter that states unambiguously—without discussion—the new strategy of innovation and technology development. There is in fact no definition of ‘innovation system’ given, so we are not able to tell which (or what type of) interpretation of the IS conceptual approach is being employed. Nevertheless, based on the section in which the ‘innovation system’ term appears, its surrounding context, and the way in which it is presented—the diagram is particularly instructive—it is clear that the term ‘innovation system’ is used merely to denote the assemblage of organizations and institutions (although not all of them are included in the diagram) that can possibly affect innovation and technology policy in Hong Kong. The roles of the institutions are detailed in a preceding chapter of the Consultation Paper, but crucially, the linkages—both their nature and intensity—are not detailed in the Consultation Paper at all, much less in the diagram or discussion under the heading of ‘Innovation System.’

This view is supported by my interviewees’ responses to a question I posed regarding their understanding of what the term ‘innovation system’ denotes. In most cases I did not receive a direct answer to this question, but

in cases where I did, for example from Interviewee #4, I found the answers to be antithetical to the underlying meaning given to the IS conceptual approach by its original proponents: “Hong Kong’s innovation system is, right now, quite weak. The Government is trying to help in that regard to make it stronger. We are implementing policies, based on what we have learned from previous policy successes and failures. This [learning] cannot be done overnight, however; we have to take it step-by-step. Our recently released [Consultation] Paper is a move in that direction” (paraphrase of interview conducted on 29 Jul 04). Here we have vague assurances of an effort to strengthen Hong Kong’s innovation system, but no indication that the effort is informed by an understanding of the crucial role of interactions among the various elements of an innovation system. The Consultation Paper is meant to support the idea that Hong Kong’s innovation system is being strengthened, but with no reference whatsoever to linkages or relationships among the various components of the system, it is difficult to understand what the effort to strengthen it entails. If this interviewee wished to assure me that initiatives based on the IS conceptual approach were under way, surely he would have mentioned specific linkages as targets of prescribed policy steps.

We can understand the gap that exists between the ITC’s understanding of the IS approach and its true conceptual content by further comparison of the Consultation Paper’s diagram with that of the OECD. The primary advancement that the development of the IS approach in the academic domain has made lies in replacing an outmoded linear model of an innovation system with the nonlinear, interactive model depicted in the OECD’s diagram. Here we find multiple feedback loops and intermediate

outputs as knowledge flows back and forth among the component parts of an innovation system. The Government's idea of innovation policy as depicted in its diagram adheres tightly to the pipeline or linear model of innovation, in spite of one or two upwardly pointing arrows at the periphery. For the most part, if we follow the 'Focus' axis of the diagram, we find the customary steps associated with the linear model of innovation, which include the typical starting point of 'basic research,' followed by 'applied research,' 'product and process development,' 'pilot introduction,' 'manufacturing,' and 'technical follow-up.' The classical linear model is thus replicated in full and presented under the diagram's heading of "Innovation System under the New Strategy."

Yet in explicating the origins of the IS approach (cf. most notably Kline & Rosenberg 1986), Sharif (2006a) demonstrates that the linear model of innovation is precisely what the originators of the IS conceptual approach were pushing *against*. Furthermore, the IS approach is much deeper and broader in usage (see, for example, OECD 1997) than is indicated in the Consultation Paper, especially in emphasizing, among other things, linkages among constituent elements of a system and contextual factors and historical trajectories (the strengths and weaknesses of an economy). In other words, even in terms of the application of the descriptive dimension of the IS conceptual approach, there are inconsistencies in the way the approach is being implemented in Hong Kong.

#### 4.1.2 *Role of the IS Conceptual Approach in Hong Kong's Innovation and Technology Policymaking*

We can ask, then: What is the place and use of the IS conceptual approach in Hong Kong's innovation and technology policymaking? The Consultation Paper explicitly assumes that an innovation system exists and that it should be more efficient; hence the use of the title to the diagram: "Innovation System Under the *New Strategy*" (my italics). In the policy document, the innovation system is a "natural" entity, given as self-evident and taken as an object of systematic planning. This is assumed despite the doubts that some proponents of the idea have expressed as to whether it is sufficiently rigorous (notably Edquist 1997). It appears, then, that the definition of an innovation system adopted by the ITC, in serving as a conceptual basis for Government policymaking, corresponds to a vague, weakly normative expectation and understanding of the IS conceptual approach. That is, we can say that, when utilized in this way, the concept of an innovation system conforms to the broad objective of policymakers to map, plan, and determine the outcome of complex social processes (cf. Scott 1998).

According to Latour and Woolgar (1986), the key markers of a fact are the lack of modality and history. Once established, scientific facts are simply taken for granted by writers and researchers in their attempts to establish other facts with no trace of their origins and without doubt, belief, surprise, or even acknowledged acceptance. The art of positive scientific rhetoric, then, is the art of moving statements from heavily modalized positions to less-modalized positions (Sismondo 2004). If we examine the section on the



'innovation system' in the Consultation Paper again (HKSAR 2004: 17), we can detect a less-modalized position. The brief statement offered in the explanation is, "Figure [3.1] below illustrates the innovation system . . . under the new strategy." There are no modal indicators such as "the *proposed* innovation system under the new strategy," or "the *modified* innovation system under the new strategy," or "the *recommended* innovation system under the new strategy." In other words, there is no reference to doubt, debate, surprise, or even acceptance. In the case of the Consultation Paper, the key rhetorical device may well be the *brevity* of the text, with the shrewdly labeled diagram in place of additional text. The diagram serves as the single most effective reducer of modality, thereby allowing the IS conceptual approach, as *understood by the Government*, to perform the positive rhetorical role of validating and adding credibility to its independently formulated policy claims.

Given that the IS conceptual approach is used in this manner, we must ask what purposes it serves policymakers in Hong Kong to deploy the approach, or what difference it would make *not* to use the IS conceptual approach. Based on the recent history of innovation and technology policymaking in Hong Kong, the influences on technology policymaking I have identified, and the bases upon which policies are formulated, I conclude that making use of the innovation system idea serves two particular purposes.

On the one hand, the IS approach is used to *justify* independently formulated policy. To illustrate this, it is instructive to note the point at which the IS conceptual approach is presented in the Consultation Paper, as it suggests that its function is to validate policy that has been formulated without informed consideration of what it means to use the approach. This conclusion

is supported by Interviewee #4, who expressed the view that, although the Government remains abreast of academic and policy developments, including the IS approach, it does not necessarily know what it means to apply that approach: “We [the Government] have a team of people working in our department. This team conducts research and they always monitor developments occurring in the policy or academic worlds, so we know about the IS conceptual approach. We think it is a useful concept. We have used it in our recent [Consultation] Paper” (paraphrase of interview conducted on 29 Jul 04).<sup>11</sup> When asked *how* the conceptual approach was used, my interviewee responded, simply, “We show what Hong Kong’s innovation system looks like.” Again, there is no analytical dimension indicated by my respondent’s answer. This is consistent with the complete absence elsewhere in the Consultation Paper of any reference to the IS approach. Nor is it recognized that the concept of an innovation system was meant to serve as an analytical or focusing device with which to evaluate and conceptualize innovation and technology policymaking in Hong Kong—precisely the use its proponents see as providing its main value. Simply put, this demonstrates that the Government has not grasped the full value of utilizing the IS conceptual approach—neither in a descriptive manner nor, much less, in its normative manner.

In addition to referencing the IS approach (albeit incorrectly) to justify the Government’s policy approach from a conceptual perspective, the Government is also using it as a means of *gaining public credibility* for independently drafted policies. Over the course of my interviews with key

---

<sup>11</sup> When I asked to meet with or interview members of this team of researchers, my request was politely declined. I was unable to acquire any further details about who introduced the concept or how they learned of it.

policy advisors and Government bureaucrats, I heard repeatedly of the need to justify policies to the public in a climate of heightened accountability triggered by the budget cuts (which in turn were enforced as a result of the recession). Interviewee #3, for example, commented:

The political climate in Hong Kong has certainly changed dramatically since the Handover [of sovereignty from Great Britain to China in 1997]. A number of factors have contributed towards that: the Asian Financial Crisis, of course, the SARS outbreak, the proposed merger of the two [main research] universities, and so on. And the effect that these changes have had is to make people in Hong Kong much more skeptical, much more cynical if you like, about what the Government does and why it does it. Politics certainly plays a more important role today that it did several years ago (paraphrase of interview conducted on 23 Jul 04).

In such a climate, it has become increasingly important for the Government to cloak its policies—especially with regard to a new and untested area of policymaking—in the highest level of scientific expertise possible. In this instance, the expertise is drawn from the OECD. Interviewee #8 concurred with this view when stating, “We have to show the Hong Kong people that what we are doing actually makes a difference; that it is internationally accepted; that this is the way it is done in the developed world, in the Silicon Valleys and so on. It is up to us to show them that innovation and technology can be helpful for them, for Hong Kong” (paraphrase of interview conducted on 6 Aug 04).

#### 4.2 *Rhetorical Use of the IS Conceptual Approach and Science and Technology Policymaking in Hong Kong*

Policy documents published by the OECD (for example, OECD 1992, 1997, 1999) have played a constitutive role in the formulation of an internationally shared policy framework for science and technology that reflects a reasonably coherent worldview with the basic principles of policymaking underpinned by the IS approach. In the analysis of innovation and policymaking in Hong Kong, the rhetorical approach to science and technology, and particularly technology policy formulated by transnational organizations such as the OECD, is a useful resource that the Hong Kong Government can use in rationalizing its own policies. Here is an off-the-record reconstruction of what Interviewee #4 said in expressing the necessity of the OECD's backing:

We do put a lot of effort into ensuring our policies are well thought through. We do not just act blindly in arriving at our policy formulations. Our policies usually follow internationally accepted practices as found in the major publications, such as the OECD. When we see that the OECD and its member countries are adhering to certain guidelines, it helps—for international comparisons—that Hong Kong also follows the same international guidelines. Hong Kong is an international city! This helps when we want to compare ourselves to, say, Singapore or Taiwan or any of our other neighbors. The OECD is a major international body that offers standards and guidelines that many countries try to follow, including Hong Kong, of course. ... The OECD has published reports on the innovation systems model showing it is an important model. ... It is best practice (paraphrase of interview conducted on 29 Jul 04).

In their study of policymaking in Québec, Albert and Laberge (2007) have shown that international organizations—such as the OECD and the United Nations Education, Scientific, and Cultural Organization (UNESCO)—

in collaboration with international experts produce, teach, and thereby establish worldwide norms for science and technology policies and organizational structures. These norms range from analytical categories to organize thinking about scientific questions and directing science and technology policies to standards for the collection of data on scientific activities. My research now adds to that of Albert and Laberge in showing that the perceived prestige of the OECD helps encourage adherence to the IS conceptual approach, creating a validation or 'lock-in' effect for OECD usage including, of course, the IS conceptual approach.

In Hong Kong, this adherence to the conceptual categories contained in the OECD's Oslo Manual on innovation (OECD 1997b: a manual devoted specifically to the measurement of innovation) and the Frascati Manual (OECD 1994: a manual devoted to the measurement of research and development activities alone) can be seen in the newly introduced *Annual Survey of Innovation Activities in the Business Sector* (HKSAR 2002), which was the first conducted by the Census and Statistics Department in Hong Kong in assessing the level of technological sophistication in the economy. The survey states in its introduction that "in designing the survey, reference has been made to the international standards promulgated by the OECD" (HKSAR 2002: 1). These global standards make it possible to compare national scientific and technological capabilities by referencing a historically entrenched international network of actors and actants who contribute to the adoption of the IS conceptual approach, including adoption of measurement standards that co-construct (on a micro scale) the future adoption of conceptual approaches.

Responses from my interviewees suggest that the OECD is perceived as an agency that confers legitimacy on the theoretically based ideas that aid in innovation and technology policymaking. Take, for instance, Interviewee #11's stance on the need to align Hong Kong's innovation policies with OECD practices: "Hong Kong, as an international city, has an obligation to follow commonly accepted practices and rules used by the most advanced countries throughout the world. Such norms are clearly written out in OECD documents" (interview conducted on 30 Oct 06). A similar view was echoed by Interviewee #12, who stated: "The OECD is among the organizations that local [Hong Kong] innovation policy *must* adhere to if we are to be taken seriously [in our emphasis on innovation and technology development]. They provide international guidelines for others to follow" (author's italics; (paraphrase of interview conducted on 2 Nov 06). This legitimacy is not, however, predicated on how the IS conceptual approach is intended for use in practice. Nevertheless it serves to provide justification for the Consultation Paper's policy recommendations. This view was captured in Interviewee #5's statement: "We [the Hong Kong Government] are on the right path as we are following internationally accepted norms and conventions—just look at our consultation document; we use the innovation systems approach. We are adopting best practice—moving in the right direction" (paraphrase of interview conducted on 31 Jul 04).

#### *4.2.1 The Use of Labeling as a Rhetorical Device to Achieve Legitimacy*

What we have, therefore, is the use by Government officials of the innovation systems label as a rhetorical device to rationalize Government policy. Studies of the rhetoric of science and technology have identified various forms of persuasion that are used to strengthen arguments in scientific text. In his analysis of the usage of the IS conceptual approach in Finland, Miettinen (2002) shows that arguments and words cannot be understood merely in terms of whatever inherent validity they may possess or in terms of their connection to empirical data. They are also loaded with meaning that serves their authors' purposes and are always addressed to particular audiences. Every piece of scientific writing or speech involves choices, and different choices have different effects. Godin (2005b) also shows how the concept of a 'knowledge-based economy' was also only an umbrella label, resurrected by the OECD, based on an alignment of previously-collected indicators and a reorganization of categories.

It appears therefore that the Government's use of the IS conceptual approach in its Consultation Paper is a rhetorical attempt to rationalize and enhance the credibility of its independently formulated policies. By including a token section with an accompanying diagram representing the IS concept, the authors of the Consultation Paper made a rhetorical choice. In particular, the title of the diagram and the language used—with no indication of modality—were both selected for their effects. Finally, the IS conceptual approach is in this way reified, in that a potentially abstract or tentative conceptual approach

is made into a 'given,' a self-evident and tangible entity. In the context of the Consultation Paper, the IS conceptual approach has thus become an object of planning and description to be integrated in policy statements with no reference to the debates or problems surrounding it.<sup>12</sup> That is, in the form in which it is presented in the Consultation Paper, it is neither loose nor ambiguous.

This use of innovation systems language in the Consultation Paper strengthens the perceived legitimacy of the proposed new strategy for innovation and technology development in Hong Kong. It establishes the new strategy as a fact, as *the* way forward. We can assume, that is, that the central purpose of this Consultation Paper is to establish the newly proposed way forward as the "correct" way forward. The IS approach is therefore driving neither science and technology policy nor more broadly economic development policy in Hong Kong. It is instead serving rhetorically to justify whatever policy initiatives are in place whether they reflect the IS approach or not.

---

<sup>12</sup> These problems can be categorized into three broad areas. First, whether it is appropriate even to speak of 'national' innovation systems, when different categorizations such as regional, technological, or sectoral may be more suitable (Nelson 1993; Lundvall 1998). Furthermore, given the increasing role of the multinational corporation as the dominant form of business vehicle in a globalized economy, the focus on national systems may be an anachronism (Radosevic 1998). A second disadvantage concerns its epistemological status. Because the IS conceptual approach is currently more an approach than a formal theory, many wonder whether it is simply too broad, ambiguous, and conceptually diffuse, offering questionable analytical value (Edquist 1997). Additionally, in a context in which so many factors may play a role, "assigning relative weight to particular institutions or relationships is difficult" (Reppy 2000: 3). Others argue along related lines that the conceptual approach is not neatly operationalizable. Third, because the IS conceptual approach is applied to individual countries on a 'case-by-case' basis, the constituent elements of any given innovation system may have little in common across geographic boundaries, making it difficult to carry out effective transnational comparisons. After all, every country possesses unique characteristics that affect its innovation system. Therefore comparisons between countries may not always provide useful policy prescriptions (Edquist 1997; Radosevic 1998; OECD 1997a).



## 5. Conclusions

I have analyzed the application of the IS conceptual approach in Hong Kong's policy circles. I chose Hong Kong because it has recently embarked on a new path of technology and innovation policy formulation. The Hong Kong Government began explicitly to formulate technology and innovation policy in 1998, with the express intention of making Hong Kong a major research and innovation center in the region. We should therefore have expected Hong Kong to be prime territory in which to apply the IS conceptual approach by policymakers hoping to reshape the innovation landscape during the post-1998 period.

Seen through a science and technology studies (S&TS) lens, what I have found instead is that Hong Kong's attempt to implement the IS conceptual approach has little to do with the organizational schema developed by the originators of the IS approach. I suggest two possible explanations for this. First, Hong Kong policymakers—deliberately or otherwise—are using the IS conceptual approach in a way that diverges from its conceptual foundations. Second, perhaps more fundamentally, the IS conceptual approach may itself be deficient, and its shallowness, ambiguity, and interpretive flexibility are precisely what has permitted its widespread dissemination. I leave the task of testing this latter possibility to another study.

## Methodological Appendix

Many potential interviewees in Hong Kong were extremely reluctant or outright unwilling to be interviewed and almost all, those who *were* willing to be interviewed requested or demanded anonymity. Additionally, in order to ensure such anonymity, the interviews were not recorded and therefore not directly attributable to interviewees verbatim. In light of this, and to achieve the most candid responses possible, I agreed to my interviewees' conditions.<sup>13</sup> For this reason, the quotations that appear in this paper are paraphrases of my respondents' views.

To compensate for the absence of an audio recording of my interviews, I took copious hand-written notes. A summary of the individuals I interviewed (with as much detail as I am able to offer without revealing their identities) appears in Table 2.1 below.

---

<sup>13</sup> Even after agreeing to conditions of anonymity, some potential interviewees declined to be interviewed based on their uncertainty over the possibility of being identified in the use of my interview material.

**Table 2.1:** Details of Interviews on Innovation and Technology Policymaking in Hong Kong

<b>Respo-ndent</b>	<b>Role(s) Played in Hong Kong's Innovation and Technology Policymaking</b>	<b>Date and Duration</b>
1	Consultant to the Hong Kong Government for a project on "Appropriate Science and Technology Indicators for Hong Kong," 1999; Academic	8 Mar and 28 Jun 2004, (4 hrs total)
2	Member of the Chief Executive's Commission on Innovation and Technology, 1998 and 1999; Special Hong Kong-based Member of the 'Council of Advisors on Innovation and Technology' (established 20 Apr 2000)	15 Jul 2004, (1.75 hrs)
3	Consultant to the Hong Kong Government for a project on "Appropriate Science and Technology Indicators for Hong Kong," 1999	23 Jul 2004 (2 hrs)
4	Senior Administrative Officer, Policy Development, The Innovation and Technology Commission (ITC), HKSAR Government	29 Jul 2004 (1.5 hrs)
5	Member of the 'Steering Committee on Innovation and Technology' (established 20 Feb 2004)	31 Jul 2004 and 7 Nov 2006 (3.5 hrs total)
6	Science and Technology Park Council Board Member; Applied Science and Technology Research Institute Board Member	2 Aug 2004 (2.5 hrs)
7	Special Advisor to the Innovation and Technology Commission, HKSAR Government; Academic	3 Aug 2004 (1.5 hrs)
8	Member of the Chief Executive's Commission on Innovation and Technology, 1998 and 1999; High-ranking bureaucrat in the Commerce, Industry and Technology Bureau, HKSAR Government	6 Aug 2004 (1.5 hrs)
9	Member of the 'Steering Committee on Innovation and Technology' (established 20 Feb 2004)	6 Aug 2004 (1.25 hrs)
10	Special Hong Kong-based Member of the 'Council of Advisors on Innovation and Technology' (established 20 Apr 2000); Member of the Commission for Strategic Development	13 Aug 2004 (2.25 hrs)
11	Hong Kong Science and Technology Parks (HKSTP) Board Member	30 Oct 2006 (written response)
12	Chief Executive Officer of a major, post-1998 established research and development organization	2 Nov 2006 (1.5 hrs)
13	Hong Kong Jockey Club Institute of Chinese Medicine (HKJCICM) senior board member	27 Oct 2006 (1 hr)
14	Chief Coordinator of one of the five R&D Centers established in Spring 2006	2 Nov 2006 (1 hr)
15	Chief Coordinator of one of the five R&D Centers established in Spring 2006	7 Nov 2006 (2 hrs)

## References

- Albert, Mathieu, and Suzanne Laberge. 2007. The legitimation and dissemination processes of the innovation system approach: The case of the Canadian and Québec science and technology policy. *Science, Technology and Human Values* 32:221-249.
- Baark, Erik, and Naubahar Sharif. 2006. Hong Kong's innovation system in transition. In *Asian innovation systems in transition*, edited by B.-Å. Lundvall, P. Intarakumnerd & J. Vang. Cheltenham, UK: Edward Elgar.
- Edquist, Charles. 1997. *Systems of innovation: Technologies, institutions, and organizations*. London: Pinter.
- Edquist, Charles, and Leif Hoemmen. 2008. *National Innovation Systems in Ten Small Countries*. Cheltenham, UK: Edward Elgar.
- European Commission. 1996. *First action plan for innovation in Europe*. European Commission, Luxembourg.
- European Commission. 2002. *Innovation policy in Europe*. European Commission, Luxembourg.
- Fagerberg, Jan. 2005. Innovation: A guide to the literature. In *Oxford Handbook of Innovations*, edited by J. Fagerberg, D. Mowery & R. Nelson. Oxford: Oxford University Press.
- Godin, Benoît. 2005a. *Measurement and statistics on science and technology : 1920 to the present*. London: Routledge.
- Godin, Benoît, 2005b. The Knowledge-Based Economy: Conceptual Framework or Buzzword? *Journal of Technology Transfer* 31:17-30.
- Godin, Benoît. 2006. The Linear Model of Innovation: The Historical Construction of an Analytical Framework. *Science, Technology & Human Values* 31:639-667.
- Government of Canada. 2002. *National summit on innovation and learning: Canada's innovation strategy*. Ottawa: Government of Canada.
- Government of New Zealand. 2002. *Growing an innovative New Zealand*. Auckland: Government of New Zealand.
- Guston, David H. 2000. *Between politics and science : assuring the integrity and productivity of research*. Cambridge: Cambridge University Press.
- Halfon, Saul. 2006. The Disunity of Consensus: International Population Policy Coordination as Socio-Technical Practice. *Social Studies of Science* 36:783-807.
- HKSAR. 1998. *Commission on innovation and technology first report*. Hong Kong SAR.
- HKSAR. 1999. *Commission on innovation and technology second report*. Hong Kong SAR.
- HKSAR, Census and Statistics Department, Science and Technology Statistics Section. 2002. *Report on 2002 annual survey of innovation activities in the business sector*. Hong Kong SAR.
- HKSAR, Innovation and Technology Commission. 2004. *New strategy of innovation and technology development*. Hong Kong SAR.
- Hellström, Tomas, and Merle Jacob. 2005. Taming Unruly Science and Saving National Competitiveness: Discourses on Science by Sweden's Strategic Research Bodies. *Science, Technology & Human Values* 30:443-467.

- Irwin, Alan. 2006. The Politics of Talk: Coming to Terms with the 'New' Scientific Governance. *Social Studies of Science* 36:299-320.
- Jasanoff, Sheila. 2004. *States of knowledge : the co-production of science and social order*. London: Routledge.
- Kivinen, Osmo, and Jukka Varelius. 2003. The Emerging Field of Biotechnology—The Case of Finland. *Science, Technology & Human Values* 28:141-161.
- Kline, Stephen J., and Nathan Rosenberg. 1986. An overview of innovation. In *The positive sum strategy: Harnessing technology for economic growth*, edited by R. Landau & N. Rosenberg. Washington, DC: National Academy Press.
- Kraemer, Kenneth, L., Siegfried Dickhoven, Susan Fallows Tierney, and John Leslie King. 1987. *Datawars : the politics of modeling in Federal policymaking*. New York: Columbia University Press.
- Larédo, Philippe, and Philippe Mustar. 2001. *Research and innovation policies in the new global economy: an international comparative analysis*. Cheltenham, UK: Edward Elgar.
- Latour, Bruno. 1987. *Science in action: How to follow scientists and engineers through society*. Cambridge, MA: Harvard University Press.
- Latour, Bruno, and Steve Woolgar. 1986. *Laboratory life: The construction of scientific facts*. Princeton, NJ: Princeton University Press.
- Lundvall, Bengt-Åke. 1992. *National systems of innovation: Towards a theory of innovation and interactive learning*. London: Pinter.
- Lundvall, Bengt-Åke. 1998. Why study national systems and national styles of innovation? *Technology Analysis & Strategic Management* 10:407-421.
- Lundvall, Bengt-Åke, Intarakumnerd, Patarapong, and Jan Vang. 2006. *Asian Innovation Systems in Transition*. Cheltenham, UK: Edward Elgar.
- Metcalfe, Stan. 1995. The economic foundations of technology policy: Equilibrium and evolutionary perspectives. In *Handbook of the economics of innovations and technological change*, edited by P. Stoneman. Oxford, UK: Blackwell.
- Miettinen, Reijo. 2002. *National innovation system: Scientific concept or political rhetoric*. Helsinki: Edita Prima Ltd.
- Mytelka, Lynn, and Keith Smith. 2002. Policy learning and innovation theory: an interactive and co-evolving process. *Research Policy* 31:1467-1479.
- National Technology Agency of Finland. 2002. *Benchmarking innovation systems: Government funding for R&D*. Helsinki: National Technology Agency of Finland.
- Nelson, Richard R. 1993. *National innovation systems: A comparative analysis*. Oxford, UK: Oxford University Press.
- OECD. 1992. *Technology and the economy: The key relationships*. Paris: OECD.
- OECD. 1994. *The measurement of scientific and technical activities: Proposed standard practice for surveys of research and experimental development. Frascati Manual, fifth ed.* Paris: OECD.
- OECD. 1996. *Innovation, Patents, and Technological Strategies*. Paris: OECD.
- OECD. 1997a. *National innovation systems*. Paris: OECD.
- OECD. 1997b. *Oslo manual: Proposed guidelines for collecting and interpreting technological innovation data, second ed.* Paris: OECD.

- OECD. 1999. *Managing national innovation systems*. Paris: OECD.
- Parayil, Govindan, and T.T. Sreekumar. 2004. Industrial Development and the Dynamics of Innovation in Hong Kong. *International Journal of Technology Management* 27:369-392.
- Radosevic, Slavo. 1998. Defining systems of innovation: A methodological discussion. *Technology in Society* 20:75-86.
- Reppy, Judith. 2000. Conceptualizing the role of defense industries in national systems of innovation. In *The place of the defense industry in national systems of innovation*, edited by J. Reppy. Ithaca, NY: Peace Studies Program, Cornell University.
- Scott, James C. 1998. *Seeing like a state: How certain schemes to improve the human condition have failed*. New Haven, CT: Yale University Press.
- Sharif, Naubahar. 2006a. Emergence and Development of the National Innovation Systems Concept. *Research Policy* 35:745-766.
- Sharif, Naubahar. 2006b. An examination of recent developments in Hong Kong's innovation system: 1990 to the present. *Science and Public Policy* 33:505-518.
- Sismondo, Sergio. 2004. *An introduction to science and technology studies*. Malden, MA: Blackwell.
- Steneke, Nyree, Hal K. Colebatch, David T. Waite, and Nick J Ashbolt. 2006. Risk and Governance in Water Recycling: Public Acceptance Revisited. *Science, Technology & Human Values* 31:107-134.
- Tung, Chee-Hwa. 1997. *Annual policy address: Building Hong Kong for a new era*. Hong Kong: HKSAR Government.
- Tuunainen, Juha. 2005. Contesting a Hybrid Firm at a Traditional University. *Social Studies of Science* 35:173-210.
- UK Office of Science and Technology. 2002. *Investing in innovation: A strategy for science, engineering and technology*. London: Office of Science and Technology.

## **Author Bio-sketch**

Naubahar Sharif is an Assistant Professor in the Division of Social Science, The Hong Kong University of Science and Technology. In his current research program, he is investigating the development of and changes in Hong Kong's innovation system.