Exploiting Uncertainty and Ambiguity in Policymaking

Hong Kong and Investment in the Pearl River Delta Region

Naubahar Sharif
The Hong Kong University of Science and Technology

Abstract: Drawing on a case study on Hong Kong government policymaking, this paper identifies a potentially fruitful intersection between science and technology studies (STS) and policy studies whereby the latter would benefit from conceptual resources originating in STS. Hong Kong has sought stronger economic ties with the Pearl River Delta (PRD) region of Mainland China since the late 1990s, using social and economic indicators to promote increased investment in the region. During this process Hong Kong effectively expunged uncertainty (creating a "certainty trough") while constructing a definitive representation of the PRD region to serve as a social technology in public policy discourse. The paper argues that the government exploited a form of interpretive uncertainty – ambiguity – to attract potential investors, suggesting that STS concepts, such as the co-production of social technologies and MacKenzie's (1990) "certainty trough", could be effective tools for analyzing social and economic policymaking.

Keywords: uncertainty; ambiguity; policymaking; Honk Kong; Pearl River Delta.

Corresponding author: Dr. Naubahar Sharif**,** Room 3372, Division of Social Science, The Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong SAR (HK) – Email: sosn@ust.hk

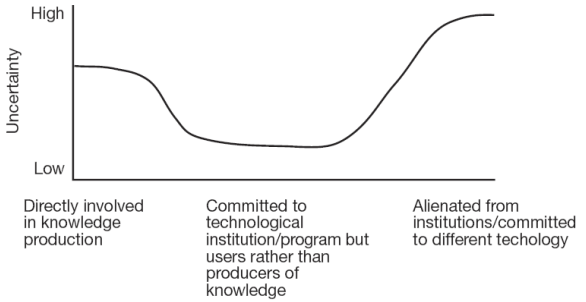
1. Introduction

Sheila Jasanoff suggests that science and technology studies (STS) would benefit from interdisciplinary "conversations" with scholars in other areas (Jasanoff 2004, 2) and in this paper I identify one site at which such a conversation might fruitfully: a case involving the construction of

social indicators by the Hong Kong government to promote investment in and stronger economic ties with the neighboring Pearl River Delta region (PRD) in China's Guangdong province. As STS scholar focusing on innovation systems and economic development who tracks Hong Kong's interest in expanding its economic relationship with the PRD, it occurred to me that, although there were no material technologies or scientific issues at stake, some useful concepts and principles established in STS – emerging in particular from the sociology of scientific knowledge (SSK) – might be applied to the relationship between experts and economic policymakers in the Hong Kong government.

My work in developing a case study of the Hong Kong government's policy towards the PRD region suggested to me a pattern in the production of technology familiar to STS scholars, involving factors through which key actors construct certainty from uncertainty in the course of producing scientific results or technologies. Such results, which are produced through social relationships involving negotiation, contestation, and interpretation, came to be known in SSK as *social technologies*. In the case at hand, the social technology in question – a representation of the PRD region that would attract business investment – was, as Theodore Porter (1995, 229) terms it, a representation of the PRD region involving "public forms of knowledge [...] shaped for policy purposes". Moreover, in producing its PRD construct, the Hong Kong government disregarded or otherwise disposed of myriad sources of uncertainty.

In this paper I explain how an iconic STS/SSK hypothesis that is commonly depicted in a figure known as the 'certainty trough' (MacKenzie 1990, 370-372; see figure 1) may be usefully applied to a non-STS context, providing a model of the process through which uncertainty was eliminated and of the relationships between actors who were involved. In this way, I hope to identify a juncture at which a conversation such as Jasanoff mentions would benefit scholars interested in policymaking by making STS conceptual resources available to them.



Source: MacKenzie, 1990. © MIT Press.

Figure 1 – The Certainty Trough

2. Social Construction of Technology

The proposition that technology and scientific knowledge are socially constructed has become common in STS. Scholarly work has revealed how ambiguous and even contradictory results from scientific and technological tests, calculations, and experiments become established as acknowledged facts[1]. Historical and ethnographic case studies have exposed how such uncertainties and contingencies are in effect set aside and thereby transformed into certainty[2].

According to this social constructivist tradition, those who produce scientific or technological results, familiar as they are with theoretical, empirical, and statistical sources of uncertainty, tend to downplay the certainty of their results, in order to preserve their credibility in case uncertainties are later revealed. Those who eventually put the results to use, however, tend to accept the science or technology as bedrock fact. In many cases opposition groups materialize, comprising actors opposed to the particular use of the scientific or technical results in the given case, and in their discourse the uncertainty returns and tends to be even more pronounced than it had been among the producers.

To illustrate this phenomenon, Donald MacKenzie, while studying the social forces that shaped the development of nuclear missile guidance technology, posited a figure with a somewhat irregular "U" shape forming a trough: the abovementioned certainty trough. MacKenzie argued that, in the production of new technologies as in the production of science (as had been previously argued by Collins 1985), facts are constructed (by 'producers') amidst acknowledged uncertainty that is effectively ignored by those whom he identified as the 'users' of technology. He then posited that the 'alienated' would re-open debate about the uncertainty and possibly identify new sources (e.g. Pollack 2012 [2007] situates the alienated in the political class).

The trough figure represents the degrees of uncertainty involved, with the trough itself representing the certainty that users attribute to what is produced. In this paper, I revisit this argument as it applies to the use of data relating to the PRD region by the Hong Kong government. The result of this effort was in itself a social technology, produced through social processes engaged in by experts and policymakers, who used public knowledge – in part by exploiting the uncertainties involved – to con-

[1] The canonical literature in which these social constructivist insights have been achieved includes Fleck (1935), MacKenzie (1981), Knorr-Cetina (1981), Campbell (1985), Lynch (1985), Latour and Woologar (1986), Collins (1987), Pinch and Bijker (1987), Wynne (1988), MacKenzie (1990), and Shapin (1994).

[2] Key studies include Star (1985), Bijker, Hughes, and Pinch (1987), Bijker and Law (1992) and Pickering (1992). More recent studies that have continued this tradition include Collins and Evans (2002) and Lahsen (2005), as well as MacKenzie (2006, 2009).

struct a representation known as the PRD region. In calling the PRD construct a social technology, I use the concept of a social technology introduced by Pinch (1987, 2), according to which a social technology includes: "processes [...] or procedures (or combinations of these) which are built around or have embedded within them a systematic attempt to change human behavior". Clearly the PRD construct is intended by Hong Kong's chief executive to change the behavior of business interests in Hong Kong by persuading them to invest in the region. In this sense, it constitutes a form of technology.

2.1. Uncertainty and Ambiguity

In my study of the use of data to promote investment in the PRD region, I found a pattern similar to the certainty trough, in which uncertainty arising in the production of those data was purged when the data were presented as settled facts (intended to constitute an attractive target for investment). I observed two forms of uncertainty: *technical uncertainty*, associated with the statistical and other techniques of measurement on which the data are based; and *interpretive uncertainty*, both in the course of collecting the statistical data and in the application of those data in practice. Technical uncertainty occurs, for example, in almost any process to which statistical methods apply, or in which degrees of tolerance must be taken into account, in short, in which it is inherently difficult or impossible to obtain perfect accuracy in measurements or predictions. Interpretative uncertainties occur whenever decisions or choices not dictated by technical or quantitative findings or measurements had to be made. Interpretive uncertainty might involve choices about how to apply a technology; or about which of several possible results of a calculation under varying conditions to accept; or about the meanings of terms or constructs that are involved in reporting or making sense of the results of tests or calculations.

I found the technical/interpretive distinction helpful in tracing how the Hong Kong government used data to identify social indicators on which to base its case for investment in the PRD, as this case was presented with no reference to such uncertainties. The real work of eliminating uncertainty here exploited another type of indeterminacy: technical and interpretive uncertainty created *ambiguity* – a form of uncertainty in its own right – that had to be eliminated in identifying or defining the entity that was to count as "the PRD region". My study identifies, then, a higher-level form of uncertainty – ambiguity – that arises in the production process and is exploited to construct a definitive representation of the PRD region, which lies at the bottom the certainty trough, for the government's rhetorical purposes.

Before analyzing Hong Kong's promotion of investment in the PRD region, I should clarify an important point. The literature in which the

social construction of scientific knowledge was conceived bears a somewhat oblique relationship to my central argument. New scientific knowledge and related technologies that have been analyzed by STS and SSK scholars typically involve highly specialized work in what Collins and Evans (2002) call "esoteric science", areas characterized by a wide gap in scientific and technical expertise between the producers and the users. The gap in the Hong Kong PRD case is quite different, as the indicators in question do not rise to the level of complexity or technicality involved in, say, climate modeling (see, for example, Lahsen 2005). The technical uncertainties involved in producing these indicators are in principle manageable because they can be easily quantified (Baker *et al.* 2013). Nevertheless, in the process through which the government obtained these indicators, that uncertainty was transformed into certainty. Although esoteric uncertainty exists in both cases, it stands at several removes from the policymaking arena here.

In summary, then, my argument is that the Hong Kong government, led by successive chief executives and relevant bureaus, exploited a source of ambiguity (namely, uncertainty inherent to the production of key social indicators) in order to create a rhetorical construct (the PRD region) which represents an attractive environment for investments on the part of business actors in Hong Kong.

3. Methodology

The material on which this paper is based was collected through documentary research, including interviews of Hong Kong government officials, data from official Hong Kong government statistics, statistics from Hong Kong government-sponsored agencies and Chinese government, plus newspaper articles. Former Hong Kong chief executive Tung Chee Hwa's annual policy addresses from 1997 to 2003, additional policy statements made by his successor, Donald Tsang Yam Kuen, and other members of the Hong Kong government in 2008 and 2009 (as well as a major conference on the Pearl River Delta held in Hong Kong in 2002) were the major sources of documentary information pertaining to Hong Kong's top-echelon political leaders. The context within which to interpret these findings was established in part through interviews conducted with officials within the executive branch of government and with officials and consultants associated with government-sponsored organizations[3].

[3] Officials included then-chief executive Tung-Chee Wha and his personal secretary, Vivienne Chow. The two Hong Kong government-sponsored organizations are the Hong Kong Trade Development Council (HKTDC) and Invest Hong Kong (InvestHK). The HKTDC is charged with promoting external trade. It also creates and facilitates opportunities in international trade, especially for small and

Data analysis involved examining both governmental and quasi-governmental sources of statistics and comparing the results to uncover interpretive uncertainties and to determine from which sources Hong Kong ultimately drew its figures. The content of speeches and newspaper reports on government statements was used to indicate the government's emphasis on the PRD as a site for business investment. Regarding the interviews, although I was able to make out the broad outlines of the process through which the indicators were determined, I did not interview members of the government with the certainty trough in mind. When I began to explore the applicability of the certainty trough to the case, I hoped to be able to develop an ethnographic account of the process.

4. The Pearl River Delta Region

The PRD region, situated within Guangdong province, is named for the Pearl River, which flows just south of Guangzhou and then spreads east and south to form a large estuary between Hong Kong and Macao. The river links the city of Guangzhou to Hong Kong and the South China Sea and is one of China's most important waterways for trade.

4.1. Hong Kong's Investment Policy

Since 1997, Hong Kong has expended considerable effort in promoting the expansion and intensification of its economic ties with Guangdong, and in particular with the PRD region. The Asian economic crisis of that time added to Hong Kong's motivation to increase its role in the Chinese economy[4].

In a conference focusing on the region's prospects held in Hong Kong in July 2002 entitled: "Forging a New Economic Force", Tung (the chief executive) vowed to "break down the barriers" with Guangdong by improving infrastructure links and expediting customs clearance[5]. "Hong Kong's potential can only be fully realized if we work together with the Pearl River Delta", he said (Tung 2002). Christopher Cheng, then head of the Hong Kong General Chamber of Commerce, echoed these sentiments

medium-sized enterprises. InvestHK provides information, assistance, and guidance regarding direct investment opportunities.

[4] In addition to Hong Kong's motivation to increase its role in the Chinese economy, the Asian economic crisis also drove new initiatives promoting innovation and technological development in Hong Kong (Sharif 2006).

[5] The conference (2002, 4-5 July) was jointly organized by the Hong Kong General Chamber of Commerce and the South China Morning Post, sponsored by Mainland Headwear Holdings Limited.

at the same conference: "As China's economy grows and changes, new ways are needed to take advantage of the growth in China" (Cheng 2002).

In the abovementioned speech, the chief executive stressed that Hong Kong can offer regionally unique business and economic benefits to the PRD region – strong rule of law, sound market principles, and good corporate governance. Hong Kong also offers overseas market contacts and an institutional framework within which to raise foreign capital. It also represents competitive advantages in trade, transport, and logistical support, as well as a thriving professional services sector. Conversely, Tung outlined what the PRD has to offer Hong Kong – an abundance of land, a high-quality inexpensive labor force, excellent infrastructure, ample investment opportunities for business, and a huge consumer market (Tung 2002).

The new chief executive, Tsang, maintained this pro-PRD investment posture, arguing in a speech given in October 2008 that:

> To stand out in the face of severe competition, we need to broaden our horizons and intensify economic integration with the Pearl River Delta (PRD) Region [...] [taking] the lead in building a Hong Kong–Shenzhen international metropolis as well as strengthening co-operation with the [PRD].

Later in October 2008, Hong Kong's financial secretary, John Tsang, advocated for several large-scale infrastructure projects, including a Guangzhou-Shenzhen-Hong Kong Express Rail Link and another railway connecting Hong Kong International Airport and Shenzhen Airport with a 29-kilometre bridge spanning Hong Kong, Macau, and Zhuhai. Addressing these major infrastructure projects, transportation and housing secretary Eva Cheng (2008) noted that their "timely implementation [...] will [...] reinforce Hong Kong's position as a premier gateway to the Mainland".

By the beginning of 2009, the pro-investment approach regarding the PRD region had been thoroughly institutionalized into government policy, as noted by chief executive Tsang in a January speech, in which he argued that Hong Kong "has a vital part to play" in the Chinese government's reform program, which targets Guangdong and the PRD for rapid development. Thus has Hong Kong pledged itself to a massive program intended to bring to fruition the intentions of a policy it has been pursuing since 1997.

Having established the priority that Hong Kong assigned to expanding and intensifying its economic relationship with the PRD region, I now examine the governmental rationale behind this policy, specifically its use of social and economic indicators of the potential return on investment. Although these indicators are subject to well known sources of uncertainty, Hong Kong exploited the resulting ambiguity to create a social technology to attract investment in the PRD region.

5. Finding the Pearl River Delta: Uncertainty, Ambiguity, and Public Policy

5.1. Uncertainty in Leading Indicators

In promoting investment in the PRD region, Hong Kong relied on several social and economic indicators to fix that entity as a rhetorical object or social technology. These included a specification of the area of the PRD region and population figures. Determining values for these indicators involved inherent sources of uncertainty, but apparently government officials considered them to be largely irrelevant.

This is perhaps easy to understand with respect to technical uncertainty. Scientific and technical test procedures inevitably involve some degree of technical uncertainty, that is, uncertainty with respect to statistical or other formal parameters that are measured in making a given factual determination or designing a technological artifact. Here I am extending the notion of technical uncertainty to scientific data with political, economic, and social significance. For example, modern census-taking methodology involves sampling and projection over populations, with measurable degrees of uncertainty. Counting a very large population with perfect accuracy is in any case practically impossible, yet governments eventually determine populations with figures that are presented as though every member of the population has been counted.

STS is of course not the only area of scholarship interested in uncertainty, which also figures in policy studies. Among the issues related to policymaking this literature addresses the difficulty of presenting knowledge based on statistical intervals (Manski 2013) and economic data (Walker and Marchau 2003; de Vries *et al.* 2010), and difficulties involved in communicating uncertainty in public policy discourse (Aikman *et al.* 2010).

In practical terms, interpretive uncertainties tell us more about how the PRD region became a social technology for policy purposes than technical uncertainties. Interpretive uncertainties in esoteric science and technology constitute uncertainties about how to apply statistical or mathematical results. McKenzie (1990, 216) observed: "MIRV [rockets carrying multiple warheads that deploy differentially at multiple points over the course of their trajectories] [...] was a technology that displayed remarkable 'interpretive flexibility,' not simply meaning different things to different 'inventors', but also being seen by different groups as a solution to quite different problems". The interpretative flexibility that MacKenzie observed is an instance of what I call interpretive uncertainty. In the case of the social and economic indicators now under consideration, however, analogous interpretive uncertainties pose considerable challeng-

es because the terms in which the outcomes must be determined and communicated are ambiguous and, in many cases, they can be disambiguated only arbitrarily. In examining the context in which Hong Kong defined the PRD region, I discovered that these interpretive uncertainties suffer a fate similar to that of analogous uncertainties in esoteric science and technology.

5.2. Quantitative Representation of the PRD Region: Persuasive Indicators

The effort to promote Hong Kong business investment in the PRD begins with some basic yet necessary questions: What exactly *is* the PRD? What geographic area does it cover? What is its population? How big is its economy? Social and economic indicators are required to illuminate these key characteristics to support judgments about where in the region to invest, how much to invest, and in which industries. InvestHK states the case as follows:

> There must be a clear understanding about the basic facts concerning the Pearl River Delta and its development [...]. Only then can they be clearly communicated to the multinational community. (Invest Hong Kong 2002)

Quantitative indicators are desirable because quantitative evidence accords prestige and power. As Porter (1995, ix) argues:

> Quantification is a technology of distance [...] [that] exacts a severe discipline from its users, a discipline that is very nearly uniform over most of the globe.

Porter continues:

> In public [...] uses, though, mathematics [...] has long been almost synonymous with rigor and universality. Since the rules for collecting and manipulating numbers are widely shared, they can easily be transported across oceans and continents and used to coordinate activities (Porter 1995, xi).

It is exactly such portability that the Hong Kong government is striving to achieve in attempting to represent the PRD region with numbers. Only by doing so are they able to convey and "sell" the attractiveness of the region to Hong Kong's populace and overseas investors – particularly to those segments of the public who may be skeptical and lacking in intimate knowledge of the PRD region or trust in the government[6]. Most sig-

[6] Given the poor state of the Hong Kong economy following the Asian Crisis in the early 2000s, regular polls had shown an alarming drop in confidence in the government, and in particular in the leadership of its then-chief executive, Tung

nificantly, by characterizing the region in terms of quantitative determinants, the government is seeking to manufacture: "a highly disciplined discourse [...] to produce knowledge independent of the particular people who make it" (Porter 1995, ix). This is especially true in areas of policymaking that are subject to political pressures, and surely Hong Kong's economic policies are such. As Porter (1995, 229) puts it: "not science, but politics, demands narrow rigor. [...] The enormous premium on objectivity [...] is at least partly a response to the resultant pressures".

Yet, as Manski (2013) notes in recent work on the treatment of uncertainty in public policymaking, couching values in numerical terms is subject to uncertainty that policymakers typically resist sharing with constituents. Manski posits the following formula to represent the broad outline of a policy analysis process such as the Hong Kong chief executive led in constructing the key indicators to represent the PRD: "assumptions + data → conclusions" (Manski 2013, 11). His point is that data alone do not suffice to justify a given policy. The two terms on the left side of the equation, "assumptions" and "data", are both subject to uncertainties, the former primarily of the interpretive type and the latter primarily of the technical type. The goal for the policymaker, according to Manksi, is to achieve "incredible certitude", by which he means that the policymaker must convince constituents of the credibility of the data involved while knowing that such data is subject to uncertainty. This creates a powerful incentive to establish the certitude of data, which in turn leads policymakers to prefer what Manski (2013, 4) calls "point predictions" over "interval predictions", providing a definite quantitative value rather than a range of possible values. As I will show, this analysis applies to at least one of the two indicators that I discuss here.

In order to show how Hong Kong treated interpretive uncertainties underlying key indicators, we review Hong Kong's determination of two such indicators (others were involved but these suffice to illustrate my point):

- the boundaries, and hence the area in square kilometers of the PRD region
- the population of the PRD region

Note that determining the area means determining the boundaries; and that determining the population also requires determining the boundaries. Note also that an area with a higher population is likely to seem more attractive to investors because it represents a larger market for goods and services.

Chee Hwa. The economy rebounded significantly in the second half of the 2010s, but was hit again by the global recession of 2008–2009.

5.3. Interpretive Uncertainty and Ambiguity: Key Indicators

5.3.1. Determining the Boundaries and Area of the PRD

A main source of interpretive uncertainty relating to the PRD is the absence of consensus on the boundaries of the region. In the aforementioned July 2002 conference, Hong Kong's chief executive mentioned improving the flow of people and goods across the border, improving transportation links, enhancing customs, immigration, and clearance services, developing express cargo services and passenger ferry services to connect ports, building regional express rail lines, and so on. But where are express rail lines to be built? Which ports are to be connected by ferry? Which airports are planes meant to use? Where do transportation links need to be improved? The answers to these questions depend on the geographical area that constitutes the PRD region: what is the exact area of the PRD region, and which parts of Guangdong province does that area cover?

The chief executive, Tung, had mentioned the PRD in 1999, when he asserted: "...the 50,000 sq. km. region encompassing Guangzhou, Hong Kong, Macao, Shenzhen and Zhuhai will become a more integrated regional economy". While Tung spoke glowingly about the region's potential, he did not delineate its borders or boundaries.

Hong Kong chief executive	50,000 sq. km
	Guangzhou, Hong Kong, Macao, Shenzhen, Zhuhai
Provincial government of Guangdong	45,000 sq. km
	Bolou County, Dongguan,Gaoyao, Huidong County, Huiyang County, Huizhou urban district, Jiangmen, Shenzhen, Sihui, Zhaoqing urban district, Zhongshan, Zhuhai

Table 1 – Varying Figures on the Size and Boundaries of the PRD Region

This ambiguity in the definition of "the PRD region" exists even though, in 1994, Guangdong officially defined the PRD Economic Zone as covering "the areas of 14 cities and counties, including all or parts of Guangzhou, Shenzhen, Zhuhai, Foshan, Jiangmen, Dongguan, Zhongshan, the urban district of Huizhou, Huiyang County, Huidong County, Boluo County, the urban district of Zhaoqing, Gaoyao, and Si-

hui" (Invest HK 2002, 5)[7]. According to this definition, the PRD covers one-quarter of the area (or 45,000 sq. km.) of the province of Guangdong.

Figures and geographical components representing the area and boundaries of the region are summarized in Table 1, making it clear that the boundaries vary depending on who defines it. I refer to these figures to show that the chief executive might have defined the PRD region differently. Two main trends can be identified. First, the chief executive uses a higher estimation of the area than the provincial government. In other words, in Hong Kong's version of the PRD region, the boundaries extend further southward. If, however, Chinese government statistics are to be used, the area of the PRD region is more clearly stated and the boundaries of the region exclude Hong Kong and Macao.

It is telling that Hong Kong did not adopt what would seem to be the official designation of the PRD region, but its motive for doing so is quite apparent, since a larger area will have both a larger population and consequently greater potential for economic development. Hong Kong was able to cite a greater area than the Guangdong government because of the interpretive uncertainty involved in specifying the components of the PRD region. There are, to be sure, technical uncertainties involved in setting out boundaries. For example, land areas determined by satellite-based imagery are subject to discrepancies related to pixel counts. If boundaries are to be determined by the use of a survey map, technical uncertainty arises because accuracy varies with the scale of the map (see, for example, Maynard 2005).

To estimate the land area and boundaries of the PRD region, however, it is understandable that such technicalities would play almost no role in shaping how Hong Kong sought to apply the concept of the PRD region. For its rhetorical purposes, defining the PRD region was essentially arbitrary, because the term "PRD region" was ambiguous. Any number of agencies or other actors might speak about "the PRD region" without being committed to a specific quantity or configuration of square kilometers. Yet the chief executive not only seems to have ignored the technicalities or interpretive uncertainties, he did not specify PRD boundaries at all, preferring simply to provide a large round number that was greater than that provided by the Guangdong provincial government.

5.3.2. The population of the PRD Region

Whenever a population for a given polity is cited, the figure is in effect a point prediction (a prediction of the figure such that, if it were possible to count every person on a given day, the count would yield that figure),

[7] 2002 Guangdong Statistical Yearbook, 541, as contained in Invest Hong Kong.

whereas in reality population is, statistically speaking, always an interval prediction because populations change every day. Depending on the variables that apply to a given population, that interval will be wider or narrower.

In his 2001 Policy Address, Tung stated: "[w]ith a population of 40 million and many affluent consumers in a number of areas, the PRD is an enormously attractive market". Yet several months later he spoke of the PRD region and Hong Kong as having "a population of over 50 million" (Tung, 2002).

Given that Hong Kong's population was 6.7 million (Hong Kong Census and Statistics Department 2001), and that of Macao was 0.44 million (Government Information Bureau of the MSAR 2003)[8], and given that the chief executive includes Hong Kong and Macao in his definition of the PRD region, this means that the population of the PRD (excluding Hong Kong and Macao) amounts to at least 42.86 million. The Hong Kong Trade and Development Council states the permanent population of the PRD to be 30 million (InvestHK 2002, 31) whereas a second governmental institution – InvestHK – puts the figure at 23.37 million (based on the figure from the 2002 Guangdong Statistical Yearbook). Finally, the population figures contained in China's 2000 census stated the population of the region to be 40.77 million (InvestHK 2002, 8). See Table 2 for a summary of the differences.

Hong Kong chief executive, 10/2001	40 millions
Hong Kong chief executive, 07/2002	42.86 millions
Hong Kong Trade Development Council	30 millions
InvestHK (Guangdong Statistical Yearbook)	23.37 millions
Fifth National Chinese Census, 2000	40.77 millions

Table 2 – Varying Figures on the Population of the PRD Region (excluding Hong Kong and Macao)

Why this rather large discrepancy? The main reason, explains InvestHK, is that the census population includes the PRD migrant and floating populations, whereas the sub–40 million figures do not. As the PRD has begun to prosper economically, large numbers of individuals from provinces far and near have flocked to the region seeking higher incomes[9]. It is difficult to obtain accurate counts of either the migrant or the floating populations. Those in the floating population have no residence associated with them and many avoid being counted for fear of being sent back to their home areas (Liang and Ma 2004). The migrant

[8] Figure rounded off to the closest 10,000.

[9] There are 23 provinces in China, 5 autonomous regions and 4 municipalities.

population is difficult to count because of China's longstanding household registry system. Urban migrants typically have migrated from rural areas, but their household registrations remain tied to their rural origins. The complex rules pertaining to the registration system, which depend on time spent away from the residence of registration, create interpretative uncertainty because there are gray areas within which it is difficult to ascertain the correct location for census purposes.

Clearly the Hong Kong Government would like to use the highest possible figure to make the region attractive to those considering investing there. The motive here is the same as the motive to present the largest possible geographic area for the PRD region. A larger population means cheaper labor for manufacturers; a larger market for manufacturers, wholesalers, and retailers; a larger workforce for multinationals; and so on. Yet if the rationale for the higher figures is utilized, the question immediately arises whether they represent primarily a labor force or primarily a consumer market and, if so, what kind of consumer market, given that most migrant workers tend to repatriate the larger portion of their earnings back to their homelands or home provinces. There are, then, a range of uncertainties – technical and interpretative – involved in census taking of which the Hong Kong government has made no mention in promoting investment in the PRD region.

6. Discussion: Eliminating Uncertainty and Exploiting Ambiguity

The pattern we have seen in Hong Kong's policymaking approach regarding investment in the PRD region is no doubt repeated in policymaking circles across the globe. Following this pattern, technical and interpretive uncertainties that are characteristic of the processes through which various government agencies collect data and make calculations to support their policy initiatives are in effect ignored, allowing the policymakers to assert with apparently total confidence that their policies will succeed. In so doing, the inherent social scientific uncertainties suffer the same fate as that of analogous uncertainties in the production of esoteric science.

I turn now to a seminal figure in the social constructivist canon – Donald MacKenzie – to provide a reference point that illustrates the aforementioned pattern, by which Hong Kong policymakers selected data that were subject not only to standard sources of technical and interpretive uncertainty, but also to ambiguity. To promote investment there, Hong Kong arbitrarily gave a specific meaning to the term "PRD region", creating a social technology for attracting such investment. We can see this social constructivist pattern in MacKenzie's certainty trough, which, in spite of having been devised some 20 years ago, continues to be cited

in the recent literature (see e.g., Collins and Evans 2002, 287; Lahsen 2005, 896; Evans *et al.* 2010).

This is not to say that the Hong Kong chief executive and his advisors were aware of themselves as negotiating uncertainty away. What they wanted was an attractive construct – the PRD region – to sell as a target of investment. As I was gathering data to build a case study illustrating Hong Kong's policy, I realized that the PRD region was likely constructed through a social process similar to the one MacKenzie analyzed in positing the certainty trough. If I am right, policy scholars would have much to learn by treating policy instruments as social technologies and examining their development using the techniques pioneered in STS and SSK.

Although I did not conduct the sort of research that would reveal the social relations and processes through which Hong Kong policymakers and their government experts constructed the PRD region for investment purposes, such a study would likely reflect important elements of the co-productionist framework that has attracted close attention from Jasanoff and other STS scholars. In Jasanoff's terms, co-productionism is an "idiom" through which to understand that:

> scientific knowledge [...] embeds and is embedded in social practices, identities, norms, conventions, discourses, instruments and institutions – in short, all the building blocks of what we term the *social*. The same can be said even more forcefully of technology. (Jasanoff 2004, 3)

Moreover, the co-productionist framework provides a means of exploring "how knowledge-making is incorporated into practices of statemaking [...] and [...] how practices of governance influence the making and use of knowledge" (Jasanoff 2004, 3). Such an emphasis suggests that co-productionism might prove very useful to policy studies scholars examining cases such as the one at hand. Here we have a public knowledge construct, the PRD region, which in this light seems very aptly described as co-produced by the two main actor groups involved, expert analysts and data gatherers on the one hand and executive policymakers on the other, with the result being a social technology that policymakers use to persuade the Hong Kong business and financial communities to invest in the PRD region. To paraphrase Jasanoff, the PRD region had crystalized over the course of the production process into objectified knowledge.

In broader STS terms, an object that had emerged in recent decades as its own entity through its distinctively local mix of population, culture, proximity to Hong Kong and other variables had now stabilized into a definite entity through co-production in the hands of the abovementioned actors. Jasanoff posits four "sites" of co-production: "making *identities*, making *institutions*, making *discourses*, and making *representations*" (Jsanoff 2004, 6, emphasis in original). While I would suggest that in the Hong Kong–PRD case the actors were involved primarily in making a representation of the PRD region by creating an identity for it, it is clear

that more generally any of these four sites of co-production might be involved in a given policymaking process, and that this would not be restricted to science and technology policy.

In making the case for the co-productionist idiom, Jasanoff notes that STS has traditionally paid too little attention to relations of power and the influence such relations have on the social construction of technology. Yet, as she notes, the "dynamics of politics and power [...] seem impossible to tease apart from the broad currents of scientific and technological change" (Jasanoff 2004, 14). This would seem all the more true of economic and social policy, providing yet another juncture at which STS resources might serve policy scholars well. In discussing the work of the political scientist Benedict Anderson, Jasanoff reports that on his account "nation-making crucially depends on deploying persuasive representations" and that among the instruments involved are the census, which we have seen played a critical role in our case (Jasanoff 2004, 26). While Hong Kong's construction of the PRD region may not seem like nation-making, and Hong Kong is now part of greater China, it seems reasonable to suppose that it might have the effect of expanding Hong Kong's footprint as an entity in the region. As I note below, issues involving political and economic power played into the Hong Kong-PRD case as opposition to the policy coalesced around concerns that infrastructure projects associated with the policy would disadvantage low-income citizens. Let us now, however, return to the certainty trough to see how we can map the Hong Kong-PRD case onto the figure.

The certainty trough posited by MacKenzie (1990, 372) to illustrate how technological communities experienced typical adjustments to technical and interpretative uncertainties in the course of developing working missile guidance systems for government agencies or contractors, with the latter communities adopting these technologies as though they were subject to very little uncertainty. The concept suggests that, within the scientific and technological communities that were involved in these efforts, considerable uncertainty attached to their results. These communities, as I have noted, constituted the *producers* of the technology. The government agencies and contractors who would apply the technologies in the construction of nuclear-armed devices, the *users*, descended abruptly into the trough seen in the figure, essentially ignoring the uncertainties. Later in the process, MacKenzie observed, some interested parties formed an opposition community, in which uncertainty about the technologies rose to new heights as the *alienated* sought to plant seeds of doubt.

To apply the analogy explicitly to the Hong Kong case, we would identify as the producers those agencies that gathered and analyzed data and calculated figures that constituted the indicators that stabilized the PRD region as a social technology. The executive branch, the users, then used that social technology to persuade investors in Hong Kong to invest in the PRD region; the alienated consisted of groups within Hong Kong who opposed the policy. This configuration of actors can be mapped on-

to MacKenzie's certainty trough without much distortion, although there are of course some notable differences. For one thing, the alienated are not rival statisticians or economists who would correspond to the rival scientists who preferred another MIRV technology. In the Hong Kong-PRD case the opposition raised doubts about some quantitative forecasts, although not to my knowledge the population or geographical indicators.

Thus to complete our mapping of the Hong Kong-PRD case onto the certainty trough, we identify an opposition even if it does not consist of figures comparable to the producers. That is to be expected if we are to extend the use of the certainty trough figure to public policies that are not informed by esoteric science, where the opposition of the alienated class is more likely to reflect political objectives, particularly when there is a question of distribution of power or resources. Indeed there is in Hong Kong a political party, the League of Social Democrats (LSD), which has publicly opposed the pro-PRD investment policy. Its opposition arises within a broader agenda of economic equality and redistribution of wealth, and the LSD's opposition role is perhaps best seen in its opposition to the abovementioned high-speed rail link. The LSD argues that the link's benefits will elude the lower classes and, more directly, will not prove cost effective in light of its environmental impact (I have no data indicating whether the LSD enlisted experts to support its claims).

Thus, while the LSD's opposition to the rail link – which we have seen is among the key infrastructure investments meant to support increased business investment by Hong Kong interests in the PRD region – rested primarily on political grounds, it also took issue with a type of quantification involved in making the case for business investment, by suggesting that it would not be cost effective. In criticizing such quantification, which Porter regards as a social technology in its own right, the LSD was in effect impugning the objectivity of Hong Kong's representation of the PRD region. As Porter (1995, 215) says: "no matter how rigorous" is the result of quantification, a set of actors "cannot make strong objectivity claims when it has strong rivals". This is not to suggest that the LSD represents a major threat to the configuration of power in Hong Kong, although it remains active to this day. More generally, if STS conceptual resources are to be applied in studies of social or economic policymaking, opposition classes are all the more likely to reflect political opposition.

Moreover, the case at hand does not turn on esoteric science, although of course data of the types that were involved are assumed to have some basis in scientific fact. Nevertheless, the result to be produced was, in effect, a definition of the PRD region to be used by policymakers in communications with investment communities in Hong Kong and elsewhere (for more on how producers and users co-construct meaning, see Oudshoorn and Pinch 2005). In order to use these data as constitutive of the PRD region *qua* social technology, Hong Kong's government not only set aside the technical and interpretive uncertainties, they exploited ambiguities to construct, somewhat arbitrarily, an entity that would be

known as the PRD region for the purposes of attracting investment there. There were no "facts" providing a precise definition of the PRD region so the government was able to depict the PRD region unambiguously as an entity ripe for investment.

The analogy between this process and the scientific and technological processes involved in the phenomena that MacKenzie studied underscores the important role that interpretive uncertainty plays. In referring to the interpretive flexibility involved in the MIRV case, MacKenzie (1990, 260) argues that the technology involved was in effect interpretable as applying to a range of possible outcomes, and while the social indicators cited by Hong Kong as constitutive of the PRD region involved several types of interpretative uncertainty, it is arguable that the term "PRD region" also exhibited interpretive flexibility, rendering it suitable to the government's efforts to make the case for investment. More precisely, the term "PRD region", having no determinate a priori meaning, exhibited *ambiguity* that played into policymaking deliberations, whereby the government was able to select from a range of possible interpretations of what would constitute the region.

A recent study carves out a more prominent role for ambiguity in studies of government rationality and international relations. Best (2008, 360-361) argues that even the best efforts to control uncertainty and risk fail to account for ambiguity, because: "even if we [...] resolve such uncertainties [...] we would still be faced with the challenge of interpreting [...] that information". In the context of Best's analysis of the concept of ambiguity, then, the construction of the PRD region to serve as a social technology clearly exploited the ambiguity, or interpretive flexibility, of the area, population, and GDP of the region (while ignoring the technical uncertainty). This is particularly clear insofar as Hong Kong included both itself and Macao within the PRD region, something that the provincial government of Guangdong has so far avoided, but which enhances the attractiveness of investment in the PRD region.

If we now return to Figure 1 and the certainty trough, we see that although the technical and interpretive uncertainties of the data-collection processes involved in determining land areas, political boundaries, population, and GDP may have fallen away as the PRD region was constructed, another form of interpretive uncertainty came into play at that point. Within that region of the figure, the government made rhetorical use of the ambiguity inherent in the multiple sets of figures that various agencies produced in order to construct a version of the PRD region that was conducive to making its case. For example, Hong Kong included both the floating and migrant populations in the figures that it cited. That these figures were inaccurate from a census-taking standpoint was not much at issue; populations change constantly. What mattered was that Hong Kong chose a figure that could be defended only if those populations were included, and thereby disambiguated the concept of the PRD region that was the object of its policy. From a set of alternative versions of the

PRD region, Hong Kong chose the one that best supported its position. In Best (2008, 356) terms, this was a case of "government through ambiguity".

7. Conclusions

The case of Hong Kong's promotion of investment in the PRD region illustrates how uncertainty can be ignored or exploited in policymaking. I have showed how technical and interpretive uncertainties are eliminated as policymakers move a construct into a certainty trough. That is, in Hong Kong's promotion of investment in the PRD region, the sources of uncertainty and ambiguity inherent to the processes through which it determined what would count as the PRD region are not explicitly acknowledged as the government presents the case for investment, but they provide the flexibility the government needs to justify its policy. Since there is no definitive PRD region, the government's version cannot be rejected as inaccurate, providing it with Manski's incredible certitude. Groups such as the LSD might object, but to do so effectively they will need to produce their own analyses, which are similarly subject to uncertainty and ambiguity.

Admittedly the government's conduct here is neither surprising nor earth shaking, nor is its behavior particularly contemptible. What I found interesting about this, from my STS perspective, is that the same pattern that emerged from SSK analyses on esoteric science and technology production processes is replicated in policymaking for economic development. Economic and social policymakers have their own certainty trough. No such analysis has hitherto been applied to this region. The comparison is possible, however, because in STS terms, the PRD region construct that emerged from policy deliberations is a co-produced social technology; the fate of uncertainty in the two domains – policy-relevant esoteric science and policy-relevant social science – bears a range of interesting similarities and differences. This is, of course, only one example of social or economic policymaking that might be illuminated by the analytical resources of STS, and it is likely that other cases will involve other variables and social dynamics.

I leave to other scholars the task of applying the methods of STS from which the concept of the certainty trough emerged to further study of policymaking processes in government agencies. As I discovered, it can be difficult to study social processes among government actors. Nevertheless, ethnographic studies of policymaking cultures might shed additional light on the degree to which uncertainty or ambiguity are consciously ignored in policy debate or simply do not arise once the issues involved percolate up the decision-making chain. The results of such work would seem able to inform studies in a range of disciplines that might include

sociology, political science, policy studies, and international relations – several of which are mentioned by Jasanoff as appropriate sites for conversation between STS and other disciplines – while opening up new areas of study, not just in STS.

Acknowledgements

The author gratefully acknowledges funding support provided by a School-based Initiatives (SBI) grant from the School of Humanities and Social Science (SHSS), The Hong Kong University of Science and Technology (HKUST), Project No.: SBI13HS03.

References

Ahn, N., Ahlo, J. M., Brücker, H., Cruijsen, H., Laakso, S., Lassila, J. and Valkonen, T. (n.d.) *The use of demographic trends and long-term population projections in public policy planning at EU, national, regional and local level: Summary, conclusions and recommendations*, in "European Union: Lot 1 Study Group", http://ec.europa.eu/employment_social/social_situation/docs/ lot1_ projections_summary_en.pdf, retrieved on 25 February 2013.

Aikman, D., Barrett, P., Kapadia, S., King, M., Proudman, J., de Weymarn, I. and Yates, T. (2010) *Uncertainty in macroeconomic policymaking: Art or Science?*, Paper delivered to the Royal Society Conference on "Handling uncertainty in science", London, Bank of England.

Baker, S.R., Bloom, N. and Davis, S.J. (2013) *Measuring economic policy uncertainty*, unpublished working paper, Stanford University.

Best, J. (2008) *Ambiguity, Uncertainty, and Risk: Rethinking Indeterminacy*, in "International Political Sociology", 2, pp. 355-374.

Bijker, W.E., Hughes, T.P. and Pinch, T.J. (eds.) (1987) *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*, Cambridge, MA, MIT Press.

Bijker, W.E. and Law, J. (eds.) (1992) *Shaping Technology/Building Society: Studies in the Sociological Change,* Cambridge, MA, MIT Press.

Campbell, B.L. (1985) *Uncertainty as Symbolic Action in Disputes among Experts*, in "Social Studies of Science" 15 (3), pp. 429-453.

Cheng, C. (2002) *Opening keynote address to conference 'Forging a new economic force*, in "South China Morning Post", July 5.

Collins, H.M. (1985) *Changing order: Replication and induction in scientific practice*, Chicago, University of Chicago Press.

Collins, H.M. (1987) *Certainty and the Public Understanding of Science: Science on Television*, in "Social Studies of Science", 17(4), pp. 689-713.

Collins, H.M. and Evans, R. (2002) *The Third Wave of Science Studies: Studies of Expertise and Experience*, in "Social Studies of Science", 32 (2), pp. 235-296.

De Vries, A., Halffman, W. and Hoppe, R. (2010) *Policy workers tinkering with uncertainty: Dutch econometric policy advice in action*, in H. Colebatch, R. Hoppe and M. Noordegraf (eds.), *Working for Policy*, Amsterdam, Amsterdam University Press, pp. 91-114.

Evans, R., Kotchetkova, I. and Langer, S. (2009) *Just around the Corner: Rhetorics of Progress and Promise in Genetic Research*, in "Public Understanding of Science", 18 (1), pp. 43-59.

Fleck, L. (1935) *Genesis and Development of a Scientific Fact*, Chicago, University of Chicago Press.

Government Information Bureau of the MSAR (2003) *Macao factsheet*, http://www.Macao.gov.mo/factsheet/geography_en.phtml, retrieved on 1 August, 2013.

Invest Hong Kong, The Government of the Hong Kong Special Administrative Region (2002) *The Pearl River Delta: The facts and figures*.

Jasanoff, S. (eds.) (2004) *States of Knowledge: The Co-Production of Science and Social Order*, New York, Routledge.

Knorr-Cetina, K. (1981) *The Manufacture of Knowledge: An Essay on the Constructivist and Contextual Nature of Science*, Oxford, Pergamon.

Lahsen, M. (2005) *Seductive Simulations? Uncertainty Distribution around Climate Models*, in "Social Studies of Science" 35 (6), pp. 895-922.

Latour, B. and Woolgar, S. (1986) *Laboratory Life: The Construction of Scientific Facts*, Princeton, Princeton University Press.

MacKenzie, D. (1981) *Statistics in Britain, 1865–1930: The Social Construction of Scientific Knowledge*, Edinburgh, Edinburgh University Press.

MacKenzie, D. (1990) *Inventing Accuracy: A Historical Sociology of Nuclear Missile Technology*, Cambridge, MIT Press.

MacKenzie, D. (1998) *The certainty trough*, in R. Williams, W. Faulkner and J. Fleck (eds.), *Exploring expertise: Issues and perspectives*, Blasingstoke, MacMillian, pp. 325-329.

MacKenzie, D. (2006) *An Engine not a Camera: How Financial Models Shape Markets*, Cambridge, MIT Press.

MacKenzie, D. (2009) *Material Markets: How Economic Agents Are Constructed*, Oxford, Oxford University Press.

Manski, C.F. (2013) *Public Policy in an Uncertain World: Analysis and Decisions*, Cambridge, Harvard University Press.

Maynard, J. (2005) *How accurate is the map?*, http://www.boundaryproblems.co.uk/mapaccuracy.htm, retrieved on 7 April 2007.

Oudshoorn, N. and Pinch, T.J. (eds.) (2003) *How Users Matter: The Co-*

Construction of Users and Technology, Cambridge, MIT Press.

Pickering, A. (1992) *Science as Practice and Culture*, Chicago, The University of Chicago Press.

Pinch, T. (1987) *Social technologies: To test or not to test, that is the question*, paper at the International Workshop on the Integration of Social and Historical Studies of Technology, University of Twente, The Netherlands.

Pinch, T. and Bijker, W. (1987) *The social construction of facts and artefacts: Or how the sociology of science and the sociology of technology might benefit each other*, in W. Bijker,, T. Hughes and T. Pinch (eds.), *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*, Cambridge, MIT Press.

Pollack, H. (2013 [2007]) *Scientific uncertainty and public policy: Moving on without the answers. Ann Arbor: Regents of the University of Michigan*, http://www.stpp.fordschool.umich.edu/news-events/?p=481, retrieved on 25 February 2013.

Porter, T. (1995) *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life*, Princeton, Princeton University Press.

Shapin, S. (1994) *A Social History of Truth: Civility and Science in Seventeenth-Century England*, Chicago, University of Chicago Press.

Sharif, N. (2010) *Rhetoric of Innovation Policymaking in Hong Kong Using the Innovation Systems Conceptual Approach*, in "Science, Technology and Human Values", 35 (3), pp. 408-434.

Sharif, N. (2006) *An Examination of Recent Developments in Hong Kong's Innovation System: 1990 To The Present*, in "Science and Public Policy", 33 (7), pp. 505-518.

Star, S.L. (1985) *Scientific Work and Uncertainty*, in "Social Studies of Science", 15 (3), pp. 391-427.

Tsang, D. (2008a) *Risk Management in the Global Village,* Policy address, October 15.

Tsang, J.C. (2008b), *9th Hong Kong Forum Luncheon*, Policy address, October 30.

Tung, C.H. (1999) *Quality people, quality home: Positioning Hong Kong for the 21st century*, Policy address, October 6.

Tung, C.H. (2001) *Building on our strengths: Investing in our future,* Policy address, November 11.

Tung, C.H. (2002) *Forging a new economic force*, in "South China Morning Post", July 5.

Walker, W.E., and Marchau, V.A.W.J. (2003) *Dealing with Uncertainty in Policy Analysis and Policymaking*, in "Integrated Assessment", 4 (1), pp. 1-4.

Wynne, B. (1988) *Unruly Technology: Practical Rules, Impractical Discourses, and Public Understanding*, in "Social Studies of Science", 18 (1), pp. 147-167.