THE STATE IN THE MARKET:
Courses in China's Information Technology Development Policy

A Thesis By

Matthew Vane Phillips

Major in International Cooperation
Graduate School of International Studies
Yonsei University
Seoul, Korea

December 2004

THE STATE IN THE MARKET:
Courses in China's Information Technology Development Policy

A Thesis By
Matthew Vane Phillips

Submitted to the faculty of
Yonsei University
in partial fulfillment of the requirements
for the degree of
Master of Arts

Major in International Cooperation
Graduate School of International Studies
Yonsei University
Seoul, Korea

December 2004

GRADUATE SCHOOL OF INTERNATIONAL STUDIES
YONSEI UNIVERSITY

COMMITTEE APPROVAL
Of a master's thesis submitted by

Matthew Vane Phillips

This thesis has been read by each member of the supervisory committee and by majority vote has been found to be satisfactory.

Date_____ _____
Chairperson, Sang-young Rhyu

Date _____ _____
Sangbum Shin

Date _____
_____
Jong-sung Hwang

Acknowledgements

Let me begin by thanking immensely my wife and love Gi-yeon Song-Phillips for her patience and support of me while I undertook this project. The time that I spent on this work came largely from the stock of time that I would have otherwise wished to spend simply and quietly with her. The Sunday afternoons she sacrificed to sit with me in local coffee shops while I worked on this thesis are testament to her patience and understanding. For this, I am grateful and hope to one-day return the favor. Next, let me thank Professor Sang-young Rhyu, who was my chief advisor on this thesis, for his intellectual mentorship while I was at Yonsei's Graduate School of International Studies. I have been fortunate in my young academic life to have had the mentorship of many intelligent and supportive scholars; but, Professor Rhyu (along with Dr. Mark Hawthorne of James Madison University) stands out among them for his willingness to entertain some of my more fanciful intellectual notions while simultaneously pushing me to develop these more clearly into a coherent and logical order. I also am fortunate to count him among my friends and glad to have been able to cultivate academic and personal level ties with him over the course of my studies here at Yonsei.

To my thesis advisors, Dr. Sang-bum Shin and Dr. Jong-sung Hwang, I am grateful to you for the time you both spent laboring over this thesis. Dr. Shin's knowledge of the Chinese political economy is intimidatingly impressive as is his understanding of English composition. His comments on the rough versions of this work were dead on in their critique. For his part, Dr. Hwang, who also happens to have been my employer at the National Computerization Agency for the past year, was instrumental throughout the process of this work. It was

while brainstorming with him ideas for this thesis in his office in early September of 2004 that I landed upon the hypothesis that would later become this work. It was he who steered me away from a line of erroneous IT logic I was assuming, forcing me to broaden my horizon.

I would also like to acknowledge my mother, Christine Phillips Jones. Though our distance precluded her from playing a decisive hand completing this work, her gracious support (financial, emotional, etc. . .) were, at times, the added buffer that allowed me to keep on track my studies. She was the model for me to go ahead and continue my studies she having completed 2 master's degrees in her fifties. In addition, there is my father, Bruce Eugene Phillips, who I, in many ways, emulate as a thinker. Often, when I read my own thoughts on political economy they echo points has repeatedly made to me throughout my life. In this sense, he has been my most influential academic advisor. I would also like to thank my stepfather Bobby A. Jones for his financial and emotional support during the last two years in particular. Thank you all for this opportunity!

I also want to thank my many friends (surrogate family) in Korea: Sungyum Kim, Sang-Duck Kwon and wife, Aniko, Roger, Tom (British via New Zealand), Daniel, GSIS Deuce, and the remainder of people who have added to my time while at GSIS and during this thesis. Thank you for helping keep my spirits up in Korea.

Finally, I dedicate this work to Jonas Vane and Winfred Schreiner. Thinking of you both spurred me on in this writing process at times when I would have otherwise wished to settle for less.

Table of Contents

List of Tables

List of Figures

Abstract

In spite of a per capita GDP mark of US$4,700 (PPP), China has made consistent and significant inroads within the international IT market. In theory at least, with China's huge uneducated, agrarian class and a centrally controlled domestic political order that is, at times, Draconian in IT coercion of citizens, we would not expect to find a burgeoning IT sector that is highly competitive in several sub-sectors in the international market, owing to the manifold requirements for innovation and implementation in this high-value added and highly coveted sector. Why, contrary to general economic assumptions, is this the case?

A significant swath of the existing literature regarding development in China's IT sector has downplayed the positive causal links between the government's explicit support for spawning an internationally competitive IT sector and the successful coming on the scene of Chinese owned and operated IT firms. The implications of this literature have given rise to a 'path dependent' literature, which aims to explain for divergences in technological levels.

This work, however, seeks to answer this riddle by focusing on the developmental role the Chinese state has played in conjunction with the industrial sector via science and technology policy to help establish internationally competitive domestic IT firms—in short, *putting the state into the market*

In this work, therefore, we will flesh out the decisive, independent, yet at times mutually reinforcing, variables that facilitated changing paradigms in the Chinese state's S&T policy. Namely, we will explore: a) changes in China's decision-making and policy processes and the role of bureaucratic politics; b) changes in S&T innovation

systems and networks; c) reforms in the Chinese economic system; and, finally d) the leveling effects of international standards concomitant with China's entry into World Trade Organization (WTO).

As the research in this work points out, every alteration, reform, etc . . . within China's S&T development policies has come only after a great deal of calculation and politicking within China's domestic political machinery. *In this sense, then, the state merely altered its behavior within the market rather than conformed to the market*. Divorcing the Chinese state[1] from the trajectory of IT innovation, implementation and standardization, is pointedly counterfactual. Moreover, if history sets precedent, Beijing's commitments to promote China's domestic technology industries will increase as the importance of the IT sector to the local, regional and international economies grows in scale. It is safe to assume that Beijing's commitments will grow in proportion with the IT sector's overall growth. China, it seems, is not content with becoming an IT powerhouse; it now aspires to IT superpower status. In terms of characterizing China's S&T development policy regimes, what we can expect in the future is for China, as a matter of course, between the choice of two options-- *techno-nationalism* and *techno-globalism*--China will continue to employ the hybrid policy line *neo techno-nationalism*.

[1] State here denotes central, regional and local level party officials and conco mitant policy regimes

Chapter I –Introduction

Research Puzzle and Working Hypothesis

China has enjoyed tremendous absolute gains from coordinating and interacting within the global economic order. Yet, China remains by many relative standards an underdeveloped nation within the international political economy.[2] While few would argue that China will long (<100 years) remain in the class of 'developing nations,' consensus is much more difficult to find with regards to at which point China's IT sector will rival it's East-Asian (Korea, Japan, Singapore and Taiwan in particular) counterparts within international markets. In theory at least, with China's huge uneducated, agrarian class and a centrally controlled domestic political order that is, at times, Draconian in its coercion of citizens, we would not expect to find a burgeoning IT sector that is highly competitive in several sub-sectors in the international market, owing to the manifold requirements for innovation and implementation in this high-value added and highly-coveted sector.

Yet, that is precisely what we find in the typically industrial stronghold of Shanghai, the political stronghold of Beijing, the geographically advantaged Guangdong region, the historically significant Xi'an and other IT 'hotbeds' in China. In spite of a per capita GDP mark of US$4,700 (PPP), China[3] has made consistent and significant inroads within the international IT market. Why, contrary to

---

[2] IT innovation in China, for example, as gauged by number of US Patent applications, lags well behind that of the usual suspects--US, EU, and Japan (though in recent years China has made considerable headway.)

[3] This includes SOEs, private NGEs and spin-off firms from state think-tanks and research institutes.

general economic assumptions, is this the case? This work seeks to answer this riddle by focusing on the developmental role the Chinese state has played in conjunction with the industrial sector via science and technology policy to help establish internationally competitive domestic IT firms—in short, ***putting the state into the market.***

As this research shows, S&T development policy in China has evolved in stages in the quest for a more dynamic and rewarding IT sector. As a result, the IT sector, from central research institutes to non- government enterprise exporters of the highest order, has undergone profound structural transformations. Key issues to be sorted out in this work, then, are what prompted these transformations and how has the Chinese bureaucracy adapted to these transformations? In addition, we will take stock of existing paradigms in IT development theory and seek to put China's course within this analytical framework.

Research Framework and Methodology

In this work, therefore, we will flesh out the decisive, independent, yet at times mutually reinforcing, variables that facilitated changing paradigms in the Chinese state's S&T policy. Namely, we will explore: a) changes in China's decision-making and policy processes and the role of bureaucratic politics; b) changes in S&T innovation systems and networks; c) reforms in the Chinese economic system; and, finally d) the leveling effects of international standards concomitant with China's entry into World Trade Organization (WTO). To this end, a historical trajectory of China's S&T policy regimes, and its relations with developments in the IT sector, is offered as is a systemic framework from which to approach the decision-making and policy formulation process within China's power circles.

In terms of methodology, this work approaches the transformations in China's S&T policy from a 'grounded' social science backdrop[4] where we will advance our theoretical arguments only on the grounds of observed phenomena in the Chinese state. These phenomena have manifested in varied forms since the advent of state S&T development plans. While it is beyond the scope of this work to consider every manifestation in its entirety, we have had the luxury of a significant amount of literature regarding the fine details of the states S&T policy development goals as well as the Chinese decision and policy making apparatus. One of the advantages of this work, however, is that, owing to its emphasis on an economic sector (IT), we are able to employ traditional quantitative, empirical analysis at times and when appropriate. While this data goes far in helping explain the importance of IT in Chinese transitioning economy, this data alone is insufficient evidence by which to approach changes in S&T policy. The central problem lay in assumptions in causality and the potential for mistakes, which makes it next to impossible to precisely quantify the relationship between changes in the state's S&T policies and growth in the IT sector. What is more feasible, however, is elaborating on changes in China's S&T development policy and observing congruencies between alterations in formal policy and the entering on the scene of new 'actors' as well as convergence/divergence among these 'actors' within the policy-making framework.

---

[4] For clarification on the characteristics of a 'grounded methodology' see Barney G. Glaser. and Anselm L. Strauss' *The Discovery of Grounded Theory: Strategies for Qualitative Research*, Chicago, Illinois: Aldine Press, 1967.

Review of Existing Literature

Often when considering the nexus between government and business practice in East Asia, outside observers (largely Western) find themselves trying to understand a puzzle from an educational backdrop that leaves them scratching their heads. In particular, the ritual conduct of East Asian governments within the market is so antithetical to the Western neo-liberal ideal of 'free markets' unfettered by the 'clumsy' hands of central governments that it requires new paradigms to be built in place of old, habitual assumptions. Explanations for the growth in China's IT sector are no stranger to the awkward imposition of 'free market' scholars.

A significant swath of the existing literature regarding development in China's IT sector has downplayed the positive causal links between the government's explicit support for spawning an internationally competitive IT sector and the successful coming on the scene of Chinese owned and operated IT firms.[5] Notably, World Bank economists and traditional neo-classical economic scholars continue to advise that the Chinese government follow a more 'market friendly' policy regime to deepen the country's level of technological sophistication. The goal of state policy planners, accordingly, would be to realize policy 'neutrality,' which in turn would 'free' the market to work more efficiently in the distribution of resources. Scholars in this line of thought[6], further, advocate rapidly transforming (AKA "rapid shock therapy") China's economy via trade liberalization measures and the adoption a free

[5] see Adam Segal, C. H. Kwan and Dani Rodrick's works

[6] E.g. see the works of Jeffrey Sachs

floating Renminbi (RMB) to increase the country's inflows of FDI and high-technology transfers—the backbones of a country's economic development. In recent years, we have seen the Russian economy follow such a prescription after the fall of the Soviet Union; and, in the aftermath of the Asian financial crisis, several Asian nations carried out trade and currency liberalization measures along 'market friendly' lines. Of further note, the implications of this literature have given rise to a 'path dependent' literature,[7] which aims to explain for divergences in technological levels. Accordingly, developing countries would hesitate to risk their political and financial capital on the innovation and introduction of unproven technologies. The result of which is all states are, in essence, fated to be technological followers of the leading IT states and firms who can afford the financial setbacks of failed technology efforts. C.H. Kwan, for example, relies heavily on traditional free-market assumptions to account for the current industrial and trade order in East Asia with Japan at the top followed by the newly emerged economies (NIE) (Korea, Singapore, Taiwan) and then China.[8]

The 'market stimulating' paradigm counters the neo-classical assumption that the market left to its own devices will a) spawn a trade regime ultimately favorable to the development of medium to high value added sectors; and b) more efficiently deliver the necessary resources to

[7] For a good discussion of this see Stan Leibowitz and Stephen E. Margolis' "Policy and Path Dependence From QWERTY to Windows 95," available at https://www.cato.org/pubs/regulation/reg18n3d.html

[8] Chi Hung, Kwan "The Rise of China and Asia's Flying –Geese Pattern of Economic development: An Empirical Analysis Based on US Import Statistics," a publication of the Nomura Research Institute, Japan, 2002. Also see Kiyoshi Kojima's "The 'Flying Geese' Model of Asian Economic Development: Origin, Theoretical Extensions, and Regional Policy Implications," *Journal of Asian*

those firms and institutes actively participating in such efforts. Namely, literature in this vein highlights the potential for government-business symbiosis where both work in tandem with markets to reinforce a particular sector(s) of the economy. Moreover, the 'market stimulating' literature argues that the innovation and introduction of new technologies is not inherently a 'path dependent' process determined by a state's export and industrial structure. To the contrary, as Lall and Teubal suggest, "technical choice, mastery of technologies, and major technological innovations, are part of continuum of technological efforts, undertaken in a relatively risky and unpredictable world of imperfectly understood information and an even more imperfectly foreseen future."[9]

The data support such conclusions in the case of development in China's IT sector. What a review of the data and research fleshes out is that the Chinese state has been highly active and determined in supporting the growth of internationally competitive domestic industries, and the results bear out the success of this 'market interference.' Hence, a holistic calculus of China's IT sector development, as it is supported by state think-tanks, research institutes etc . . . *must take the state into account*. Divorcing the Chinese state[10] from the trajectory of IT innovation, implementation and standardization, is pointedly counterfactual. Moreover, if history sets precedent, development in China's active IT industries will continue to work in step with

---

Economics, Vol. 11 (2000), 375-401.

[9] S. Lall and Teubal, "Market Stimulating Technology Policies in Developing Countries: A Framework with Examples from East Asia," *World Development*, Vol. 126, pgs. 1369-1385.

[10] State here denotes central, regional and local level party officials and concomitant policy regimes.

government policy initiatives.

Chapter Outline

Though instinctively we may associate IT with economic progress and high-value added production chains, it is necessary to elaborate on the interplay between IT and economic development. In the second chapter, then, we introduce the status of IT in the international economy via some very useful indicators such as IT's share of global GDP and the role IT play in transforming economies. In the second part of this chapter, we localize the relation among IT and GDP growth to the Chinese context. The central points for consideration here were again macro and micro economic indicators within the Chinese market. The importance of IT to China's short, mid and long term development cannot be emphasized enough and is certainly on par with that in other world economies, although China's domestic level of technological capabilities may fall well short of OECD nation standards at the current time. The driving force behind this elaboration is to justify the salience of focusing on the IT sector at the exclusion of other economic sectors also under girding China's meteoric economic rise.

In the third chapter, we move into making the necessary logical connection between the state political apparatus and the development of the economic policy framework. This chapter begins with a discussion of "The State and the Market," drawing on current theoretical paradigms explaining the state's role in economic development (particularly within the East-Asian development context.) Having elaborated on how state's intertwine with burgeoning national economies (macro-level) and industries (micro-level) to support overall development, the focus then shifts to the particulars in the Chinese political economy, namely the

connections between decision making, policy creation and bureaucratic structures. Relevant theoretical models are introduced to grasp the 'enigma' of the Chinese political economy; and, these models go quite far in explaining the evolution in trajectories of the state's development policy and planning. These models, however, require some alterations to accurately reflect outside (foreign) firm's role in the Chinese economy *en masse* and the IT sector in particular. A "two-tier" bargaining model, therefore, is employed to further account for relative bargaining positions at the international and domestic levels, respectively. This is followed by a section shedding light on the archetypal behaviors of Chinese central policy makers and captures these within a theoretical framework explaining the modes available to states within the international political economy. The resultant model goes far in capturing the essences of what Beijing's *modus operandi* will be in the new millennium.

The fourth chapter underpins our argument of state activity in fostering domestic IT firms with an analysis of the historical trajectory of China's IT development policies, and by extension science and technology (S&T) and research and development (R&D) policies. It begins with the introduction of economic reforms in Deng Xaoping's 1980s China. Here, we see China attempting to model itself after the successes of it's North-East Asian neighbors Korea and Japan. Beijing burdened itself with establishing large SOEs and in efforts to spawn their innovative potential while relying on market incentives shielded these SOEs from international competitors by denying competitors access to the local markets, much as the Japanese and Koreans did in

earlier periods (and to some extent remain guilty of in today's political economy.) This approach, however, proved unfruitful and Beijing's planners and policy makers decided to change it's development courses. During this period, the early to late 1990s, non-governmental enterprises were permitted to shall shares of stock and operate within the domestic economy. The chapter endeavors to outline the new forms of Beijing's policy and model the new innovation system Beijing envisaged.

In the next chapter, and perhaps most importantly to our discussion of IT sector development, we turn our focus to the current S&T policy regime and flesh out some defining characteristics of the policy regime in light of China's WTO ascension. Here, we attempt to answer the following critical questions: How has China's IT development policy altered to conform with accepted international practice (as standardized by the WTO) and what remnants of the previous decades IT development policy still linger in the Chinese policy structure?

This work concludes by taking up the question of China's ability or inability to leapfrog through stages of industrialization. In short, we make the case that the 'path dependent' model of IT integration and development is naïve and contrary to Beijing's intentions. Finally, we end by offering some suggestions for further research into China's S&T development; namely, we suggest that the types of and methods in local level S&T development initiatives need be weighed proportionately in relation to central development plans.

Chapter II- The Information Technology Sector and Economic Development

Economic Growth and IT

In recent years, the international economy has witnessed explosive growth in the information technology sector, spurred on by the near universal applicability of most IT and the recognition, by most governments, that the value and production chains created by high-value IT sectors will continue to drive nation-state economies well into the new millennium. The working definition of IT used in this work refers to "all forms of technology used to create, store, exchange, and use information in various forms (business data, voice conversations, still images, motion pictures, multimedia presentations, and other forms, including those not yet conceived.)"[11] This includes both the computer sector and telecommunications sector. In the computer sector, IT include software, hardware and the various manufacturers who produce them. On the telecommunications side, IT include equipment manufacturers, telecom service and online providers.

In 1999, 30% of the globe's economic growth came from the information technology and IT industry sectors.[12] Since then, IT's share of the global world economy has increased. The innovation and production of IT also creates added production chains in the economy, which are a boom to employment, wages, and the overall domestic

[11] Definition from the "Technology Encyclopedia" at www.techweb.com

economy; hence, the net benefits of IT innovation and implementation extend beyond increases in TFP and share of total exports.[13] In addition, once introduced into the government's processes, IT help streamline operations enhancing bureaucratic efficiency. Yusuf also points to IT enabling further linkage between rural and urban centers, whose economies are generally divergent. IT creates converging pressures as new IT introduction offers fiscal and efficiency rewards for the poorest farmer to the wealthiest banker. This, in turn, will increase demand for new IT, in turn giving rise to new firms in the sector—the 'virtuous cycle.'

In a nod to the importance of technology and implicitly the IT sectors in particular, the 2002 World Investment Report of the United Nations, states ``sustained export growth tends to involve a move up the technology ladder from simple to complex products in addition to upgrading quality and efficiency in existing exports.''

A large part of this 'upgrading quality and efficiency' results from the introduction of new high technologies into the manufacturing and production process. These improvements can be realized two ways: 1) the domestic creation of new technologies i.e. technological innovation; or 2) the adaptation of new technologies created elsewhere i.e. technological diffusion. In the case of the latter, technologies can be purchased via agreement with the inventor, introduced via FDI by MNC, or reverse engineered from original blueprints.

Suffice to say, the relevant benefits of the introduction of new

---

[12] Figure from the Yearbook of World Electronic Data 2002.

[13] For a good discussion of this see Shahid Yusuf's. *Innovative East Asia: The Future of Growth*. Washington, DC: World Bank, 2003.

IT to a state's economy are many and varied.[14] IT hold the promise of revolutionizing so many facets of the modern life and the modern economy, we are at a loss to think of one aspect of life they will not in some way effect. Certainly, however, the benefits of an active and innovative IT sector run deeper than a purely economic framework can capture. The IT field is still relatively new in comparison with more established industrial sectors, and much like we can observe with the history of these older industries, IT will effect modern economies in ways perhaps accessible intellectually now to only the most omniscient of 'futurists.'

The World Endogenized: IT and China's Economic Growth

> *"The melding of the traditional economy and information technology will provide the engine for the development of the economy and society in the twenty-first century."*
>
> -former CCP Secretariat Jiang Zemin,
> 22 August 2000

The IT sectors in China follow the global pattern of explosive growth with domestic IT sectors garnering an ever-increasing share of both domestic and global markets. The share of high-tech industries in China's total gross domestic product (GDP) reached 3 percent in 2001 and now stands at nearly 5 percent.[15] In 2001, value added in high-tech industries was 309.5 billion Yuan RMB. In the four fiscal years from 1998 to 2001, the share of high-tech industries in manufacturing GDP

[14] For the inquisitive reader refer to the source above for a more holistic treatment of the benefits of IT.

increased rose 2 percent from 12 per cent to 14 per cent.

China's high-tech industries also have played an increasingly important role in boosting China's export figures. China's total export growth from 1995 to 2001 was a sizeable 14 percent; the same figure for high-tech exports, however, was 28 percent--*double the national export growth average*. From 1995 to 2001, the share of high-tech industries in total exports increased from 9 to 19 per cent. In terms of microanalysis, the share of electric and telecommunications equipment in China's exports averaged a 23.6 percent annual growth rate from 1999-2001. The share of computers and office products as a share of total exports soared on average of 43. 6 percent annually for the same period.

Table 1: High-Tech Industry Exports, 1995-2001 (100 million Yuan, at 1995 prices)

Industry	1995	1998	1999	2000	2001	Growth rate (1999-2001)
Total high-tech exports	1125	3397	5012	6523	8179	27.8
Electronic and Telecom Equipment	712	1983	3172	4155	4825	23.6
Manufacture of Computers and Office Equipment	219	960	1263	1741	2588	43.2
Total export	**12452**	**25336**	**33566**	**39731**	**42079**	**12.1**

Sources: Exports of high-tech industries from unpublished data of NSB; total exports from *China Statistical Yearbook* (2002).

Government economists estimate the country's information

[15] Figure adapted from the Chinese Statistical Yearbook, 2004

technology sector will expand at an annual rate of 17.4 percent by 2007 to hit sales of US$63.06 billion (523. 4 billion Yuan),[16] a figure nearly double the nation's total GDP growth rate. By way of example, market analysts predict that sales of desktop units will reach 20 million and laptop sales 4 million annually.

In particular, Chinese experts and analysts are optimistic about China's information services sector. Currently, the number of Internet users with broadband connections is 7.14 million—a figure nearly three times what it was a year ago. These numbers, however, are just drops in a vast ocean of potential. According to industry estimates, 500 million Chinese will be surfing the Internet with broadband connections within the next few years.[17][18]

As world demand for value added IT increases with the spread of these technologies, IT will play an ever-greater role in spurring China's domestic growth. By 2005, the Chinese government in conjunction with non-governmental enterprises (NGE) and government funded think-tanks and research institutes is working hard to raise the proportion of the high-tech industry's added value to the gross domestic product by 50 percent from 2000 levels and raise to 25 percent the proportion of high-tech product exports to the nation's total exports.[19]

---

[16] "China's IT Growth Bullish," available at http://www.chinadaily.com.cn/en/doc/2003-08/06/content_252486.htm

[17] Ibid

[18] Of course, these figures may overstate the potential market given the nature of the political regime in China. The spread of the Internet, while desirable from a cultural and fiscal perspective, threatens the Chinese communist's Party hold on information and power. Hence, a measure of prudence is required when making estimates about China's Internet usage in the coming years. Undoubtedly however, the figure will continue to grow from the current 7.14 million. How fast and how far remains to be seen.

[19] Figures taken from the State Development Plan 2001-2005.

Chapter III- Bureaucratic Politics and S&T Policy Making in China: A Workable Framework

The State Within the Market

While no scholar would debate the truism some states have played an active role in shaping markets in the manner and context with which they prefer, the extent and efficacy to which these state actors intervene in markets remains a real debate. Proponents of the neo-classical school argue state intervention in the market is often disruptive to markets and impedes the transformation of economies by virtue of the creation of rent-seeking opportunities and a host of other negative externalities. Typically, neo-classicalists advocate smaller governments and market intervention only in case of market failures. [20]

In recent history, however, and particularly within the context of the East-Asian (Korea, Japan and Taiwan) development experience, a second school of scholars has surfaced. They contend states can, and indeed do, play a *positive* role in economic development. Chalmers Johnson argues that Japan's former Ministry of International Trade and Industry played a key role in identifying development goals and raising

[20] Among this group, there is internal debate as to when states should intervene in markets. Market failures fall into four broad categories: information asymmetries, externalities (positive and negative), monopolies, and public goods. Interestingly, in a recent article, *The Economist* raised the question of whether governments should intervene even in the case of 'market failure' questioning whether intervention in these circumstances on the grounds that, given time and non-interference, markets tended to 'work out' successfully these 'failures.'

and distributing capital to strategically chosen industrial sectors.[21] Likewise, Sang-young Rhyu, Euysung Kim and Stephen Haggard, to name a few, have noted the role of Korea's Economic Planning Board (EPB) during Korea's early development years. The EPB, they argue, was instrumental in choosing and supporting industrial sectors, with the EPBs preferred *modus operandi* being to subsidize export industries via export incentives and tax and tariff breaks.[22]

For analytical and comparative political economy purposes, not to mention the sake of debate, we may find it intellectually worthwhile to conceptualize the two paradigms in terms of polar opposites on a hypothetical continuum ranging from free-market advocates on one end to government interventionists on the other. The hyperbole between the two camps, however, often fails to hit the mark. Indeed, as Adam Segal argues, "[t]hough the state may have a positive role in development, it is rarely successful without the cooperation of the corporate sector." [23] In light of East Asia's development experience, free-market advocates have had to defer to the idea government institutions can bolster the competitiveness of domestic industries. And for their part, advocates of government intervention have been forced to recast their arguments in light of research into the interplay between state actors and private enterprises in the course of

---

[21] Chalmers Johnson, *MITI and the Japanese Miracle" The Growth of Industrial Policy 1925-75* (Stanford: Stanford University Press, 1982) 27-28.

[22] Rhyu Sang, Young, "Between International Constraints and Domestic Policy Choice: Korea's Economic Development in The 1960s" Korean Political Science Review, Vol.37, No.5 (2003) and Euysung Kim and Stephen Haggard, "The Sources of East Asia's Economic Growth," The Access Asia Review Summer 1997, vol.1, no. 1.

[23] Adam Segal, *Digital Dragons: High-Technology Enterprises in China*. (Ithaca and London: Cornell University Press, 2000) p. 6.

their conduct within the market.

In the developmental state literature,[24] the state is often presented as a monolithic entity with reaches deep into the recesses of the domestic economy as a whole. The success of these states, as Chalmers Johnson argues, hinged largely on the states ability to forge and maintain tight social links with domestic actors while maintaining the necessary degree of autonomy for policy-making technocrats. Government technocrats, who are often the educated elite, crafted coordinated policy objectives and plans for domestic industries. Dense social, economic and political networks between the state and individual firms worked to reinforce the objectives of these plans. To maintain its leadership, the state used financial and political incentives to win private firms deference to national plans. Penalties would be assessed to firms refusing to abide by state development plans and industrial orientation in the form of increased taxes and interest rates for loans and, in extreme cases, a tightening of government coffers. Firms that did 'play ball' with state development planners, by contrast, could expect fiscal rewards such as subsidies, lower interest rates for meeting planned export figures and the governments explicit promise of increased share in the domestic market. Young has highlighted the coercive role *amakudari* (in Japan) and 'parachute appointments' (in Korea) also played in maintaining dense state-firm links. *Amakudari* and 'parachute appointments' refer to the strategic placing of retired government officials (generally at the age of 55 or whenever a junior ranking member of their bureau was primed

[24] See, for example, Chalmers Johnson's *MITI and the Japanese Miracle" The Growth of Industrial Policy 1925-75* (Stanford: Stanford University Press, 1982, Alice Amsden's *The Rise of "The Rest": Challenges to the West from Late-Industrializing Economies.* New York: Oxford University Press, 2001.

to take over the position) into higher-tier positions with domestic private firms. These former government officials served as vehicles for keeping state-firm links intact and strong and represented the development interests of the state in firm decision-making. The resulting symbiosis between the state and firms undergirded the state's leadership in the development process.

The Chinese state development model while borrowing heavily from the experiences of Korea and Japan has had to differ in approach from its two smaller neighbors owing to several factors. First, China has had to unweave some 50 years of Communist-style central planning and coordination of the economy. Market signals, as such, were hard to decipher during Mao's China, and pricing mechanisms and regulations came under the auspices of central government planners, leaving coordinating mechanisms to be hashed out with inputs from policy leaders and state officials rather than the market.[25] Even in the present era, few scholars would make the case that Chinese officials and planners have completely relinquished control over some of the working mechanisms in the economy.[26] In Korea and Japan, to the contrary, government development models had the luxury of using working pricing mechanisms and market signals to coordinate their economies, although the argument is plausible that government intervention in these economies did create 'barriers' to the unfettered flows of information in the market.[27] Second, Korea and Japan were both privy to aid in the

---

[25] See Barry Naughton's, *Growing Out of the Plan: Chinese Economic Reform, 1978-1993,* Cambridge, UK: Cambridge University Press, 1995.

[26] I am thinking here primarily of the state's reigns on the Chinese Central Bank and the pegging of the Renminbi (Yuan).

[27] For a good discussion of the Korean development trajectory see Carter J.

forms of grants and loans and favorable access terms to the United States' market as both Japan (1945-52) and Korea (1945-48) were occupied territories of the United States. Part of the US' grand strategy in dealing with economic and security threats in the East-Asian region was to advance the economies of these two occupied nations so as to strengthen their domestic military capacities and to pacify overt militaristic tendencies (more in the case of Japan than Korea.)[28] Third, China is a nation with vastly different regional economies and neighbor state proximities. China is composed of 22 provinces, 5 autonomous, regions, 4 municipalities and 2 special administrative zones.[29] China is also the world's third largest country with a landmass of some 9.6 million square kilometers. The landmass of the Korean peninsula and Japanese Islands, by contrast, comes nowhere near the size, scope or geographic variance as is in China, and the same holds true for population figures. Japan, by contrast, is made up of 376,000 square kilometers spread out over the four main islands, and the Korean peninsula is 22,154 square kilometers.[30]

These factors make realizing cohesive and successful 'national economic development' a more dubious enterprise. As Segal argues, "the Chinese case forces us to view the state as a more decentralized organizational structure embedded within a range of institutional,

---

Eckert's, "Korea's Economic Development in Historical Perspective," Pacific Century vol. 11 (1995). And for Japan's see, T.J Pempel's *Regime Shift: Comparative Dynamics of the Japanese Political Economy*, 1998.

[28] Ibid

[29] For the names of each of these refer to http://www.chinatoday.com /city/a.htm

[30] The size and population figures are available at www.countryreport.org

political and social arrangements at the central and local level."[31] There is a general lack of consensus, further, among Sinologists as to the extent of the State Council of the PRC and the State Development Planning Commission's "reaches' into the Chinese economy. Attention, then, will need to be placed on the decision and policy making processes in China and the concomitant bureaucratic structures associated, and often given charge, with carrying these policies out at both the central and local levels.

Decision and Policy-Making Process models

Decision making is defined here as the "intentional and reflective choice in response of perceived needs."[32] Decision making, then, often requires choosing a course among competing options via cognitive processes involving judging, reasoning and planning.[33] In China, the completion of the decision-making process results in the formulation of an official policy framework to which all respective parties are expected to adhere. Several schools of thought have dominated discussion regarding *de facto* decision and policy-making processes within the Chinese state.

The first model takes a 'top down' approach, typically visualized in a pyramid scheme. The core assumptions of this model include a) top-level officials (predominately within CCP ranks) exercise enormous control over state policy-making; and b) these leaders in turn

---

[31] Ibid p. 7
[32] As defined by the International Technology Education Association available at http://www.iteawww.org/TAA/Glossary.htm
[33] Ibid

formulate policy in a logically rational fashion with the first order being to define existing problems or future goals and then respond to these in accordance with the leaders value preferences.[34] Works in this vein concentrate on the force of normative preferences of high-level Chinese leaders in the creation of arching national economic policies. In regards to the IT sector, scholars in this school have focused almost exclusively on the influence ranking CCP figures have in the creation and implementation of the domestic IT agenda.

The second model emphasizes the 'cellular' nature of Chinese society. The focus here lies on the policy decisions and external actors throughout the post-Mao era that have hastened the decentralization of decision-making and policy creation and the relative increase in bureaucratic autonomy of local level administrators respective to Beijing's central authorities. The literature here have focused on the specific market orientations of regions and locals and the existing industrial structures within these to explain the policy and agenda setting course for the IT sector. [35]

These two models, however, do not accurately account for the interplay between central figures and local actors. The 'top-down' approach to decision-making and policy creation overstates the role of CCP heads and policy planners. It also under-represents the bargaining clout local level officials, foreign firms, and NGE extend into the policy

---

[34] See e.g. Wenli, Zhou, "International Political Economy from a Chinese Angle," *Journal of Contemporary China*, vol. 10, Fall 2001, pgs. 45–54.

[35] The paragraphs above draw heavily from Kenneth Lieberthal, "The Fragmented Authoritarianism Model and It's Limitations," in Kenneth Lieberthal and David M. Lampton's , eds. *Bureaucracy, Politics, and Decision Making in Post-Mao China*, (Oxford: England, University of California Press 1992) pgs. 1-33.

and decision-making process. A holistic application of this level of analysis then would result in an erroneous understanding of Chinese S&T policy making. The second model, by contrast, discounts the bureaucratic authority of the state and Beijing's coordination with the Chinese central bank and state run think-tanks, research institutes and science and technology universities.

The "Fragmented Authoritarianism" model[36] incorporates the sensibilities of an elite-centered model and the 'cellular' society model. The FA model improves upon these two including into consideration " the structure of bureaucratic authority and the realities of bureaucratic practice that affect both elite and the basic building blocks of the system."[37]

Accordingly, the FA model begins with the observation that bureaucratic authority lying below the top echelon is "fragmented and disjointed." There are several reasons for this. Economic reform policies under successive generations of Chinese leaders from Deng Xaoping unleashed fragmenting and disjoining forces within the political system. Moreover, lessons learned from the failure of the 1980s attempts to spawn competitive, large-scale, state-owned IT firms, of the likes of Korea's Samsung and Japan's Mitsubishi, led to sector specific structural reforms, including the emphasis on the devolution of IT innovation to smaller, more flexible firms, and the introduction of incentive systems, which further reinforced the fragmentation of

---

[36] Ibid 13

[37] Susan L. Shirk, "The Chinese Political System and the Political Strategy of Economic Reform," in Kenneth Lieberthal and David M. Lampton's , eds. *Bureaucracy, Politics, and Decision Making in Post-Mao China,* (Oxford: England, University of California Press, 1992) pgs. 62.

decision-making authority.[38] In addition, during the 1980s and 1990s, regional and local leaders were, for the first time in decades, given greater charge of local markets. This introduced a "sink or swim" mentality within the folds of local bureaucrats who, as a recourse to the added pressures of being responsible for economic success in a formally highly authoritarian, planned economy, cultivated closer relations with small and medium non-state market actors (NGE). This process of increased collusion between local officials and NGE invigorated the policy-making process and encouraged local bureaucratic units to buffer themselves from central planners. Logically then, with a larger say in decision-making and policy formulation regional/local bureaucrats worked in tandem to protect their specific interests, as one would expect of most scaled bureaucratic organizations. [39]

i) Transformations in Bureaucratic 'Rules of the Game' and Economic Policy Making in China

The restructuring reforms of the Chinese economy have altered the internal political process enough to allow for local level officials to "block upward flows of information and to blunt higher-level initiatives that cascade down on local leaders." [40] As a result of the reforms in the Chinese economy, the 'rules of the game,' so to speak, among

---

[38] See Barry Naughton and Adam Segal's "Technology Development in the New Millennium: China in Search of a Workable Model," in William Keller and Richard Samuels, eds., *Crisis and Innovation: Asian Technology After the New Millennium,* New York: Cambridge University Press, 2003.
[39] Ibid 37 p. 64
[40] Ibid 38 p.12

bureaucratic and non-bureaucratic actors in the economic policy-making process have been transformed.[41] Hence, economic policy-making in China is divisible into two frameworks each typifying relative distinct eras.

The first framework (traditional polity) characterizes bureaucratic 'rules of the game' in the Chinese political and economic system from the communist revolution in 1949 to the introduction of economic reforms in the 1980s. 'Economic system' is defined in this work as "a social institution through which goods and services are produced, distributed, and consumed."[42] The central questions with which this system deals with are: What will be produced? How will production be organized? And how will the goods and services used be distributed? For 'political system,' owing to the nature of this work and its emphasis on political economy we are defining political system as "the complete set of institutions (ex. parliament, courts, political organizations, interest groups - such as political parties, trade unions, lobby groups), the relationships between those institutions and the political norms and rules that govern their functions (constitution, election law)."[43]

Within this traditional policy-making framework, there are three central relationships: the first being between parties who are both bureaucratic 'insiders;' the second being between a bureaucratic

---

[41] It is worth reiterating however, that these decentralized units were far from free-market advocates, and we must be careful to consider that with increased authority within political rank and file, local administrative units were expected to churn out development plans in accordance with the arching goals of Beijing's central planning authorities.

[42] N. Gregory Mankiw, *Principles of Economics 3rd Ed.*, Thompson Publishers: New York, NY, 2004.

‘insider’ and a non-bureaucrat; and the last being between two non-bureaucrats. The chart also aptly points to inequalities of power and position within the relationships as represented by the vertical and horizontal columns. The ‘vertical’ column characterizes ‘patterns of relations’ between parties with rough parity in power and position with the opposite (horizontal column) holding for parties with disparate powers and positions.

Figure 1:‘Traditional’ Bureaucratic Policy-Making Framework within the Chinese Political System

	Pattern of Relationship	
	Vertical	Horizontal (A)
Both bureaucrats	Command Patron Client Pleading(B)	Bargaining *Guanxi* (C)
One bureaucrat, one non-bureaucrat	Corruption Rent-Seeking (E) Patron Client Bargaining	Persuasion (D) Corruption (D) Rent-Seeking(D,E) *Guanxi* Bargaining
Both non-bureaucrats	Patron Client	*Guanxi* Bargaining (F)

Source: David Zweig as adapted in Kenneth Lieberthal, “The Fragmented Authoritarianism Model and It’s Limitations,” in Kenneth Lieberthal and David M. Lampton’s, eds. *Bureaucracy, Politics, and Decision Making in Post-Mao China*, (Oxford: England, University of California Press 1992) pgs. 22-23

Key:

A) Includes relations between ministries and provinces, which are the of the same bureaucratic rank in China

B) Behavior by the lower ranking of parties

C) Use of personal relations/ties to obtain favors

D) Relations between officials and foreigners, retired cadres, village elders, or others whose prestige or resources give them a position of rough equality with the officials with whom they are dealing

E) “Rent seeking” refers to a type of corrupt behavior where officials

[43] Definition from http://en.wikipedia.org/wiki/Political_system

charge "rent" to gain access to those things under their control
F) Occurs in situations of bilateral monopoly
G) Market relations in traditional polity refers only to transactions in the economic sphere

The net outcome this framework was a reliance on informal connections and a central and local bureaucracy with great degrees of control of both the distribution and use of domestic resources, characteristics typical of Marxist centrally-planned economies. With Deng Xaoping's initial economic modernization reforms in the late 1970s and early 1980s, however, came significant alterations in the 'rules of the game.'[44]

Figure 2: Current Bureaucratic Policy-Making Framework within the Chinese Political System

	Pattern of Relationship	
	Vertical	Horizontal
Both bureaucrats	Persuasion Command Policy-guidelines (A)	Quasi-market(B) Bargaining *Guanxi*
One bureaucrat, one non-bureaucrat	Corruption Rent-seeking Bargaining	Corruption Rent-seeking Bargaining (C) Policy guidelines Quasi-market
Both non-bureaucrats	Patron-client Policy guidelines	*Guanxi* Bargaining (D, E) Quasi-market

Source: My own adaptation of Zweig's 'current polity' framework. Refer to earlier models source.

The framework above characterizes the 'rules of the game' in

[44] Greater detail regarding the specifics of these reforms is given in the later chapters.

China's current policy-making process. We notice that in the case of two bureaucrats of equal position 'policy guidelines' has been introduced into the framework. This is an extremely important distinction to note. Beginning with the introduction of 5-year state development plans and the imposition of central and local ministries and officials into the policy making process, development guidelines have played an active role in shaping the context and trajectory of Chinese development. (The success of this practice notwithstanding.) The following chapters IV and V go into extensive detail regarding the evolution of Chinese S&T policy regimes, but for now, it will suffice our efforts to have an understanding that policy guidelines have been key in the functioning of the Chinese economy *en masse*. Also of note is that 'corruption' and 'rent-seeking,' which are perennial scourges of the Chinese economy and polity, have not been eradicated by China's 'market liberalizing' reforms, but rather, in the current political-economy, opportunities for 'corruption' and 'rent-seeking' remain particularly rife. There are several reasons for this with respects to the IT industry in particular:[45] 1) the development and implementation of IT in China was, until the late 1980s, almost wholly within the auspices of the Chinese People's Liberation Army (PLA.) The PLA's nearly exclusive control of and access to endogenous and foreign IT hampered market development,

[45] This information is repeated in several sources e.g., Yong Deng and Fei-Ling, Wang's " Toward and Understanding of China's World View," in Yong Deng and Fei-Ling Wang's *In the Eyes of the Dragon: China Views the World* (Lanham, Maryland: Rowman and Littlefield Publishers, 1999) pgs. 1-26 and Frederick Tipson's "China and the Information Revolution," in Elizabeth Economy and Michael Oksenberg's eds. *China Joins the World: Progress and Prospects,* (New York, NY: Council on Foreign Relations, 1999) p. 231.

and the very hierarchical structure of the PLA was replicated in control of domestic IT production and application; 2) with the devolution of power and policy making authority to lower level party cadres and regional affiliates, Beijing's control over official elements decreased, ripening conditions for system abuse, particularly in regions without historic access to international markets of any sort and few, if any, foreign owned-enterprises in operation; 3) the non-liberalization of the Chinese market in effort to protect domestic industries directly contributes to 'rent-seeking' as does the near monopoly status of many domestic IT firms."[46]

'Quasi-market,' further, has been added to the framework. In the case of two bureaucrats, 'quasi-market' refers to the tendency of local and central officials to 'feel' where international and regional markets are heading and coordinate policy and sector development in accordance with market forces provided it serve the domestic and political agenda. In the case of relations where both actors are bureaucratic outsiders, the same general philosophy holds. These two parties will coordinate decisions and policies generally in line with where international and regional market forces are guiding production and innovation. ***The market, however, will be tempered by domestic political and economic concerns as distinct from international development concerns.***

By way of example in the IT industry, consider relations between the Chinese Academy of Science, which has done extensive research into the development of IT, and a Chinese-owned NGE. The

---

[46] See Norton and Segal

two will work in coordination with respect to development, exchanging ideas and even exchanging engineers and developers. The resultant product will be a collaboration of the two, and ideally, when the new IT product is brought to market the economic rewards will be shared. Such research institutes and domestic firms collaboration is not particular to the Chinese case. What is distinctive however is that the Chinese Academy of Science also collaborates with central and local officials with respects to the research and development of IT and the process of codifying IT standards. The CAS is a direct research affiliate of the Ministry of Science and Technology headquartered in Beijing. A sizeable portion of the Academy's funds come from state sources with the implicit understanding that China's development trajectory need be first and foremost a concern in the innovation and application of IT. The Chinese Academy of Science has helped launch several IT spin-off firms. The China Sciences Group, China Investment Corporation For Sciences & Technology – CICSTD, Oriental Scientific Instrument Import & Export Group, Huajian Group Ltd.Co., Kejian Group, and finally but certainly not least, the Lenovo Group (formerly Legend Group) are a few of the successful NGE still under 'control' of the CAS.

This might at first seem quizzical to Western readers not accustom to state intervention in domestic economies. The distinction, however, is an important one to make. Admittedly, the term 'quasi-market' fails to capture the complete essence of the interaction between the Chinese state and the market. By demarcating the two though, it will help us to conceptualize the relations.

Finally, relations between foreign firms and domestic NGE will be characterized by 'bargaining' within the backdrop of the market as

opposed to purely acquiescing to the market trajectory. Lieberthal defines bargaining as 'negotiations over resources among units that effectively have mutual veto power."[47] This qualification we find to be ideal, especially given the East-Asian context. Bargaining may occur under situations characterized by unevenness in the distribution of power and authority. In fact, the Westerners experience in Asia typically is riddled with occasions for bargaining with local/regional/central administrators who wield considerably greater leverage in the decision-making process. This, however, does not preclude outright the potential for the two parties to work towards a consensus of opinion equally appealing to both parties. Lampton writes, ""bargaining occurs because leaders believe that the gains to made by mutual accommodation exceed those to be made by unilateral action (if that were possible) or by foregoing agreement altogether." The working definition employed here denotes discussions and negotiations over the distribution of finite resources among interested parties.

ii) Chinese S&T Development Policy Making: A Two-Tier Policy-Making Model

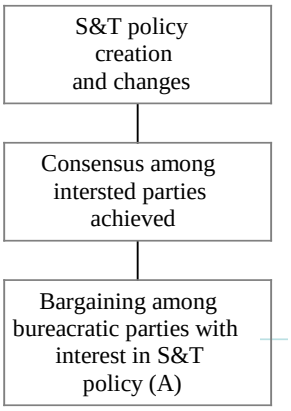
Localizing this framework to China's S&T development, the fragmenting of authority in China created a bargaining atmosphere where the search for mutual consensus formed the building block for formulating and implementing development goals in the IT sector. Bargaining among interested parties has been essential to the S&T development of policy initiatives in China.

---

[47] *Ibid* 13

Figure 3:

China's S&T Policy-Making Framework



Key: A) Details regarding specific bureaucratic actors given later in this section.

Although bargaining is not listed *per se* in relations between bureaucratic insiders with vertical power positions and non-bureaucrats of rough parity in position in the frameworks outlined earlier, bargaining is a key component in the process of S&T policy making and, by extension, policy guidelines. Indeed, there is a growing amount of literature from Chinese scholars regarding the central role bargaining has played at every (macro, micro) level of Chinese development. This, unfortunately, is a recent (early 1990's) phenomenon.[48] The reasons for this are several-fold. Centrally, the Chinese political economy is so enigmatic and structurally antithetical to what one encounters in the United States and even in the European welfare state political economies

[48] e.g., Peter Lovelock and John Ure's, "Telecommunications and Policy-Making in China: A Two-Tier Bargaining Model," Telecommunications Research Project, Centre for Asian Studies, University of Hong Kong, 1998, and Kathleen Walsh's, "Foreign High-Tech R&D in China: Risks, Rewards and Implications for U.S.-China relations," a publication of the Henry L. Stimson

that painting a coherent picture of the Chinese system is a veritable task; when this is coupled with the dramatic reforms of China's recent years the task is all that more daunting. We must also consider that access to Chinese leaders and policy makers for western scholars has, in large part, been restricted, rendering at best an incomplete picture of actual formal and informal political and economic arrangements.

Going further, development and production in China's IT sector also must account for differences in bargaining outcomes and policy choices with respects to domestic and foreign actors. In the current polity framework outlined earlier, no distinction is made between bargaining processes at the international level and the domestic level, though the framework does hint at this consideration as it includes foreign firms in the calculus. Yet, as many detailed studies have shown,[49] the standards and course trajectories of S&T development policy and concomitant regulations (macro-level) has a) differed with respects to bargaining counterpart (either domestic or international); and, as a result b) altered relations among actors within the IT sector (micro-level). Hence, we will apply Lovelock and Ure's "two-tier bargaining model" for China's telecommunications sector to the case of China's IT sector. The 'upper-tier' of the model represents China's economic relations with the outside world while the 'lower-tier' represents purely domestic level policy negotiations.[50]

'Upper-tier' policy decisions are guided according to Beijing's

---

Center, Washington, DC, 2003.

[49] Peter Lovelock and, John Ure , "Telecommunications and Policy-Making in China: A Two-Tier Bargaining Model," Telecommunications Research Project, Centre for Asian Studies, University of Hong Kong, 1998.

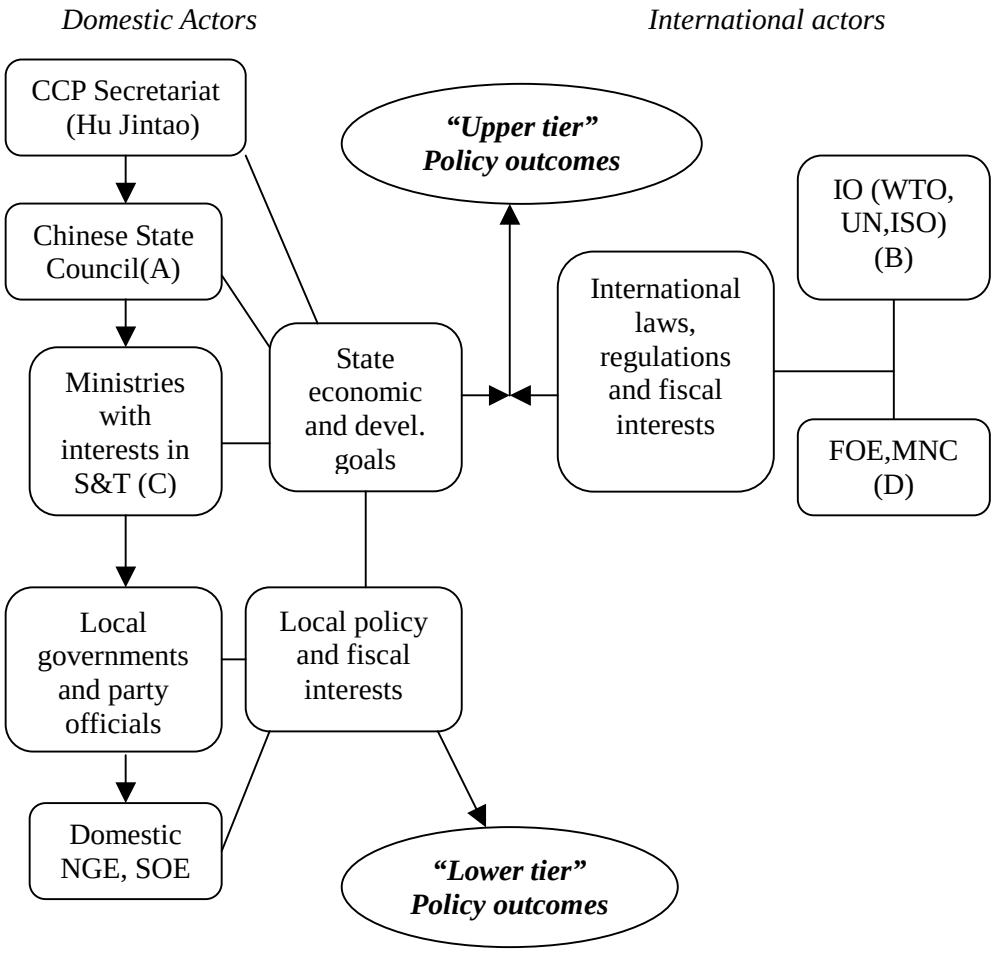
[50] For a fuller understanding of the hypothesis refer to *ibid* pages 8-12

export-oriented growth goals and regional and local development requirements. Respect for so-called 'international norms' and 'rules of the playing ground' characterize China's interactions at this level. After all, if Beijing is to attract foreign investment, especially in the often sensitive and politically charged IT sector, they will have to acquiesce to international standards of practice and law. Lovelock and Ure also correctly point out, however, that Chinese officials are not mere passive spectators at these negotiations, but, rather, come to the table with their own criteria. At this level, we find Chinese officials often using the promise of access to China's vast potential market to increase their bargaining positions vis-à-vis multinational corporations (MNC) and wrangling with international bodies governing terms of trade and finance, (WTO, World Bank etc . . .) over trade barriers and tariff rates. Pointedly, for foreign-owned firms the bargaining model must include two levels of analysis: macro and micro. At the macro level, FOE must bargain with state officials, respective ministries and, perhaps, central bankers. The aforementioned state officials may either be central figures in the CCP headquartered in Beijing or regional and local party cadres in locales where the FOE operates. Bargaining at this level will include discussions over IT sector regulations, tariff rates, wage figures (provided the CCP or People's Congress has raised this issue) and exchange rate stability measures. At the micro level, FOE will have to negotiate with partner domestic firms over terms of trade, production, technology transfers etc . . .

The 'lower-tier,' by contrast, refers to policy decisions without the additional constraints of international institutions and legalities. Government officials and CCP technocrats often control decisions at this

tier. And as we elaborated earlier, much of the bargaining process occurs within a "disjointed' framework with emphasis on cohesion and consensus.[51]

Figure 4: Organizational Chart for Major Bureaucratic Interest Groups in S&T Policy Creation and Implementation



[51] We should note however that consensus building is not particular to this tier. Undoubtedly, the process of bargaining with MNCs and IOs can lead to a type of consensus-building process characterized by accessions and "give and take" to reach agreement.

Key: Vertical arrows represent flows of information and influence. Horizontal arrows denote processes of negotiations and the actors whom typically associate with each other.

A) The Chinese State Council is comprised of the Chinese Premier Wen Jiabao, the four vice-Premiers, Huang Ju, Wu yi, Zeng Peiyan and Hui Liangyu.
B) International Organizations (World Trade Organization, United Nations and International Organization for Standards)
C) Details regarding some of these ministries given in below.
D) Foreign-Owned Enterprises, Multi-National Corporations) The arrows from FOE, MNC represent their negotiations with Chinese actors. These negotiations do not extend directly to China's supreme authorities. However, their wishes may make into discussions at these high levels e.g. Hu Jintao's courting Bill Gates and Microsoft to have mainland Chinese software engineers officially develop the Chinese language software for Microsoft's programs rather than Taiwanese software engineers.

The list of ministries and political bodies with an interest in S&T policy and development is extensive. We, therefore, focus on the central players who are respectively: a) State Planning and Development Commission (SPDC); b) Ministry of Science and Technology (MOST), Minister Xu Guanhua; c) Ministry of Information Industry (MII), Minster Wang Xudong

d) Ministry of Finance (MOF), Minster Jin Renqing; **e)** Ministry of National Defense (MND), Minister Cao Gangchuan; f) Chinese People's Liberation Army (PLA), Supreme Commander Hu Jintao; g) Commission of Science, Technology and Industry for National Defense (COSTIND), Minster Zhang Yunchuan; and finally, h) Ministry of Foreign Affairs (MOFA), Minister Li Zhaoxing.[52]

As we can see from the chart above, the CCP Secretariat has the final say as regards the overall course and language of China's S&T

policy. Interestingly, the current Secretariat's, Hu Jintao, background is originally in engineering rather than political science or economics. Hu Jintao graduated in 1965 from the Water Conservancy Engineering Department of Tsinghua University.[53] Under Hu Jintao is the Chinese State Council whose primary task is to handle the day-to-day administration of China. The State council also doubles as the "clearinghouse for all government initiatives."[54] With respects to the development and implementation of S&T development policy, the State Council is given charge to: a) implement the laws and resolutions adopted by the National People's Congress (NPC) and its Standing Committee and draft legislative bills and proposals for submission to the NPC or the Standing Committee; b) direct and coordinate the affairs of every administrative sector. It does so by formulating the tasks and responsibilities of the ministries and commissions and by issuing administrative measures, rules, regulations, decisions, orders, and policy decisions and monitoring their implementation; c) supervise local government administration; and d) oversee international diplomacy efforts.[55]

MOST is directly subordinate to the State Council. According to MOST, its primary responsibility is to accelerate China's economic growth via S&T.[56] Some of MOST's responsibilities include:[57]

---

[52] In-depth introduction of ministries available at www.chinaonline.com

[53] Biographical data available at http://www.china.org.cn/english/PP-e/48915.htm

[54] From http://www.chinaonline.com/refer/ministry_profiles/c01022661.asp

[55] The details given above come verbatim from resources gathered at www.chinaonline.com

[56] For this and more detailed descriptions of MOST's goals see the ministry's website http://www.most.gov.cn/English/index.htm

1) Formulate strategies and plans for science and technology development as well as policies, laws and regulations that accelerate socioeconomic development through science and technology;
2) Optimize the allocation of science and technology resources and administering the science and technology budget;
3) Promote innovation capacity;
4) Strengthen basic research and new and high- technology development; and
5) Oversee implementation of key basic research projects and the high-tech research-and-development (R&D) program.

As we may gather from the information above, MOST works in conjunction several other ministries in towards its ultimate objective of improving China's S&T levels. To begin, MOST must coordinate with the State Planning and Development Commission (SDPC). The SDPC is largely responsible for drafting China's five-year plans to guide China's economic and social development, of which the industrial sector is a huge part. The SDPC also coordinates with MOST and other relevant ministries regarding the construction of China's technology infrastructure. In addition, there is the MII. The merging of the former Ministry of Post and Telecommunications with the Ministry of Electronics and Information in 1998 spawned MII. MII is primarily responsible for the oversight of telecommunications, multimedia, broadcasting, satellites, and the Internet.[58] For example, MOST and MII are combining efforts to help local development for the third-generation technology platform, time division-synchronous code division multiple access (TD-SCDMA).[59]

We have included MOFA in the organizational chart owing to MOFA's role as the central role in negotiating bilateral and multilateral

---

[57] Ibid
[58] see the ministry's website http://www.mii.gov.cn/

treaties including the one signed with the WTO. In the earlier section, we adopted a framework that accounted for an 'upper tier' in the policy negotiation and formulation process. As we will elaborate upon later, with China's ascension to the WTO and its acceptance of the *Technical Barriers to Trade Agreement*, the influence of these 'upper tier' bodies-- international regulatory organizations like the WTO and the UN-- has increased exponentially.

MOST must also harmonize its efforts with MOF. MOF is primarily responsible for charting China's macroeconomic courses and supervising the procurement of funds for economic development agendas.[60] The two agencies established the 'Technology Innovation Fund' in 2000 to subsidize small and medium size firms in the IT sector.[61]

The final ministry included at this level in the organizational chart is MND. Much as the name suggests, the MND is responsible for building up national armed forces, which includes the structure and setup of the armed forces, armaments and scientific research for national defense among others.[62] Connected to the MND are the PLA and COSTIND. Of these, the PLA has the greater say with respects to the course in China's S&T policy. As we noted earlier, prior to the economic liberalization under Deng Xaoping the implementation and innovation of new IT devolved almost exclusively to the PLA. Although this is no longer the case, modernizing the PLA, pseudonym for preparing the PLA for high tech warfare, remains a top priority for the Central

---

[59] http://www.chinaonline.com/refer/ministry_profiles/C01051537.asp

[60] For more on the ministry's role see the ministry's website www.mof.gov.cn

[61] Chapter V of this work goes into greater detail regarding this fund.

Military Commission (CMC) whose head is Hu Jintao.[63] COSTIND is given the specific task of introducing high technology into the PLA. With the increasing interchangeability of high technologies in the military and civilian sectors, COSTIND and PLA work step in step.[64] COSTIND also helps the PLA coordinate the innovation and implementation of new high technologies with think tanks, research institutes and universities.

At the next level are local government officials e.g. provincial governors and heads of Local People's Congress' (LPC) followed by local party officials and local bureaucrats below the governor or local leader level. At the bottom are China's non-governmental enterprises. It is fair to argue that at these levels is wear a lot of the so-called 'grunt work' is done with respects to implementing S&T policy. Yet, here is where we find the custom tailoring of central government dictates to fit better local industry and economy structures. The relative power of actors at this level will increase as Beijing further decentralizes authority.

In the earlier section, we outlined 'patterns of relations' between these bureaucratic bargaining groups, and we refer the curious reader back to this section for a fuller understanding of how these agencies interact and the institutional 'rules of the game' concerning bargaining. The end results of this bureaucratic bargaining and jockeying for position will be the framework for S&T policy and IT sector cooperation and development, as outlined earlier in our policy creation model. The frameworks given above allow for greater

---

62 See http://www.chinaonline.com/refer/ministry_profiles/c01043067.asp
63 Ibid
64 Ibid

understanding as to the primacy of political economy in China's S&T policy-making. With this understanding of the policy-making framework, we can now turn our attention to discussion regarding the particular S&T policy regimes available to China in its quest for IT development.

Convergent/Divergent Interests: S&T Development Policy in the Post-WTO Ascension Era

> ***"****We [the CCP] will resolutely guard against and fight the infiltrative, subversive and separative activities of all hostile forces and effectively guard against and deal with various risks from the international economic field, so as to safeguard China's political, economic, cultural and information security"*
>
> ---From the 'Decision on the Enhancement of the Party's Governance Capability' by the CCP's Central Committee
> September 2004

As the focus of this work is changing paradigms in China's S&T development policy, we will explore the policy lines available to China in its efforts to hasten IT development. Indeed, the crux of our argument lay in clarifying the continual refinement in China's S&T policy line from one end of the spectrum towards the other. We can visualize these policy choices on a continuum with *techn-globalism* on the far right and *techno-nationalism* on the far left. The definition of *techno-nationalism*[65] used here refers to a theoretical and practical policy

[65] The definitions of techno-nationalism and techno-globalism are discussed many places; however, the curious reader can refer to Sylvia Ostry and Richard R. Nelson, *Techno-Nationalism and Techno-Globalism: Conflict and*

paradigm characterized by government's targeting of specific (usually high-tech) industries in an effort to increase the strength of domestic firms via regulations, tariffs and subsidy regimes favorable to domestic producers. *Techno-globalism*, by contrast, is a plus-sum game rather than a zero-sum game whereby, ideally, all nations and firms would cooperate and coordinate in the innovation and application of new technologies. *Techno-globalism* is an extension of the concept and practice of *globalization*, which is characterized by the increased interrelatedness among parties and players and the blurring of national boundaries. Following this logic through then, the concept of a "domestic" firm is erroneous as the intellectual property of firms would be available to the global community rather than a nation or set of nations; and, international markets will drive the innovation process forward rather than governments or private-public partnerships.

As Yamada Atushi aptly notes,[66] however, these two theoretical concepts, *techno-nationalism* and *techno-globalism* are "ideal types." Various arguments have been advanced for the polarized policy lines. Economic rationalists, naturally, argue for adopting a *techno-globalist* approach; *techno-nationalism*, they argue, by contrast, creeps into policy regimes as a result of domestic firm rent seeking and outstanding political concerns.[67] Another group of scholars[68] point to changing

---

Cooperation. Washington, DC: The Brookings Institution, 1995.

[66] Yamada Atsushi, "Neo-Techno-Nationalism: How and Why It Grows," *Columbia International Affairs Online*, March, 2000, <www.ciaonet.org/isa/yaa01>.

[67] See Anne O. Krueger's "The Political Economy of the Rent-Seeking Society," *American Economic Review*, vol. 64 June 1974 pgs. 291-303.

[68] See Sylvia Ostry and Richard R. Nelson, *Techno-Nationalism and Techno-Globalism: Conflict and Cooperation*. Washington, DC: The Brookings Institution, 1995.

tides in the domestic economy to account for the policy vacillations—when the economy is booming governments tend towards *techno-globalism* while economic recessions and increases in competition with foreign market rivals elicits a techno-nationalist response. Finally, there are those who argue that some states (i.e. Japan and South Korea) are 'inherently' *techno-nationalist* while still yet others (i.e. the US and UK) are 'inherently' *techno-globalist*, owing in large part to their market orientation.

In actual practice, states employ a hybrid of the two policy lines, which Atushi coins *neo techno-nationalism.*[69] States navigate strategies according to their stated goals. Atushi writes, "nations take *neo techno-nationalistic* policies in order to meet the challenges posed by *glocalization* and advance their own interests in a *glocalized* economy."[70] [71] Given the choice of two options, states regularly employ whichever policy line is most conducive to their position in the international political economy at the time.

On the surface, for states to pursue their own narrow technological self-interest may seem antithetical to the ripening of the fruits of *techno-globalism*--cooperation and coordination among states in the innovation and application of new technologies. Conceptually, however, it is consistent. States can pursue their narrow self interests while concomittantly improving technology levels. We are reminded here of Adam Smith's famous maxim that man, by serving his own

---

[69] Yamada Atsushi coined the term neo techno-nationalism, though surely the idea of a hybrid policy somewhere between the extremes of techno-nationalism and techno-globalism existed prior to Yamada's coining.
[70] Ibid p. 3
[71] Glocalization refers to the dual-evolving processes of globalization and localization in the IPE.

economic self interest, ultimately benefits the national economy as a whole. The argument global technology levels can advance via the pursuit of narrow self-interests is simply a logical extension of Smith's maxim.[72] Moreover, in China's case, with its sizeable domestic demand potential and high education levels, inflows of FDI and the promises of technology transfers from MNC wanting access to China's domestic market make it all the more plausible that benefits can accrue to Chinese technological levels as well as the worlds from China's narrow pursuit of its self interests.

Table 2: Differences among the three "isms"

	Techno-Nationalism	**Techno-Globalism**	**Neo-Techno-Nationalism**
Policy goal: Promote whose interests and how?	National interests by preventing globalization	Global interests, by leveraging globalization	National interest, by leveraging globalization
Who leads innovation	Government targeting	Global market forces	Private initiative and public-private partnerships
Open/closed toward foreigners	Closed	Open	Open under certain conditions
Prospects for conflict/ cooperation	Conflict	Cooperation	Cooperation *and* conflict

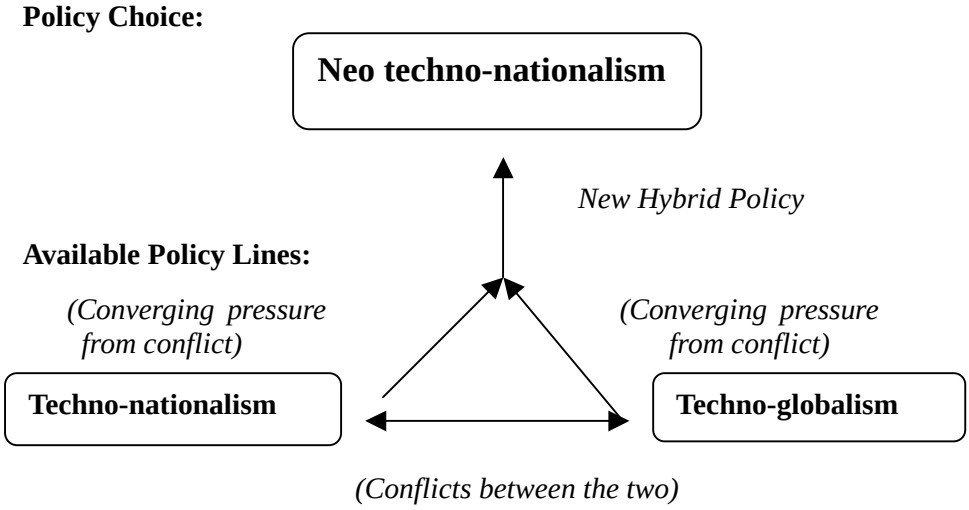
Source Yamada[73]

[72] Adam Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations* New York, NY: Random House Publishers, 2000.

[73] Yamada Atsushi, "Neo-Techno-Nationalism: How and Why It Grows," *Columbia International Affairs Online*, March, 2000, <www.ciaonet.org/isa/yaa01>.

i) The Chinese Case for Neo Techno-Nationalism

Figure 5: Modeling China's post-WTO Ascension Technology Policy



The model above conceptualizes changes in China's S&T development policy as a result of the conflict between divergent interest groups in Chinese political economy. As we can see, at the top is the new hybrid policy line *neo techno-nationalism*. On both sides of the model, we can see "converging pressure from conflict." This refers to pressures from both foreign and domestic sources. The composition and desire of the individuals, groups, firm etc . . . will decide where they fall in line with the above model. The pressures from the conflict between bureaucratic interest groups espousing divergent S&T policy lines

(*techno-globalism* and *techno-nationalism*) gives impetus towards relying on the new hybrid policy (*neo techno-nationalism).* Due attention, then, must be given to convergent and divergent "forces" among actors in the Chinese political economy.

Currently, two groups of policy '"forces" are driving the development of China's IT industry. The first are those pushing for S&T development via economic reforms and opening-up (*techno-globalists*), with the focus squarely on the potential for enterprises; the second group, on the other hand, espouse relying on S&T policies that directly promote the state's heavy involvement in the development of IT industry. As a complete list of 'forces' active in driving Chinese S&T policy would be stupendous, we have narrowed these 'forces' to what we hope is an overarching grouping that captures many of the actors responsible for the 'pressures' within its folds. The risk in using such a methodology is in being hyper deductive in our logic, overlooking phenomena that do not fit the theory. To remedy this, we have allowed for divergent interests within 'factors.'

First, we must take into account China's regional and global security concerns and the role these play in China's policy choice. The working assumption here is that lingering security concerns hamper efforts by bureaucratic actors lobbying for a *techno-globalist* policy regime. The central actors hampering *techno-globalist* aspirations are the PLA, MND and associated ministries with primary responsibility for ensuring China's national sovereignty. For example, the Chinese-US political relationship waxes and wanes periodically. Consensus in Beijing, however, is that the US is a "strategic competitor" for regional

and global economic and political power.[74] Chinese officials hold the same line for the Japanese. Political and social relations between Japan and China remain strained near the point of snapping.[75]

The dynamics in China's domestic politics also tend to hamper efforts towards a more *techno-globalist* regime. As China's economy has made the unmistakable turn away from the planned economies of Mao and Marx, the CCP increasingly has grown to rely on Chinese nationalism to legitimize its rule. This, in turn, dovetails easily into Chinese technological nationalism with the emphasis on domestic firm innovation and implementation and a mistrust of international firms and standards. That said, this need not be the case. Owing to the hierarchical distribution of power in Chinese politics, if CCP control fell into the hands of a leader with *techno-globalist* visions, domestic politics could be altered to support such aims. Currently, this is not the case—Hu Jintao has signaled his respect for the *status quo* in China's S&T development policy on a number of occasions.[76]

In connection with these forces driving towards a *techno-nationalist* line is lingering frustration within China over royalty payments to foreign firms. Chinese officials[77] are increasingly weary of

---

[74] Weixing Hu, , Gerald Chan, , and Daojiong Zha. *China's International Relations in the 21st Century: Dynamics of Paradigm Shifts.* Lanham, Maryland: University Press of America, 2000.

[75] The collective Chinese memory vividly recalls the Japanese atrocities in Nanking in 1937-8 and Manchuria in the 1920's. China's ruling party, the Chinese Communist Party (CCP), was born as a revolutionary body to rid China of the imperial invading Japanese.

[76] e.g. see details in Chapter VI.

[77] This, however, is not entirely a Chinese phenomenon. Governments in technologically stronger and weaker nations alike increasingly are weary of the fees domestic firms and users must pay to foreign inventive firms.

royalty payments and patent fees. Royalty fees cut into Chinese domestic firms manufacturing costs, hence shrinking their profit margins. Moreover, as the interoperability of IT increases and the diffusion of IT becomes more widespread, China's indignation at paying royalties will only increase. Chinese policy makers, then, will try to remedy the negative externalities associated with its previous technological "backwardness" and emphasis on technological absorption at the expense of domestic "catch-up."[78]

Working in conjunction with this frustration to undermine efforts towards *techno-globalism* is the fear of dependency on MNC for technology and China's concomitant position within the international division of labor. The 'patent trap,' as it is often referred, refers to the dependency countries lower on the horizontal ladder of technological capabilities have on international leaders for patented technologies. International leading firms and nations, generally speaking, maintain the intellectual property rights to many of their innovations and, quite often, there is not a technologically comparable substitute on the world market for these technologies. As a result, the 'patent trap' can unleash forces within China leading to a 'vicious' (as opposed to 'virtuous') economic cycle whereby China, owing to its inferior technological state in comparison with international leaders, finds the gap between itself and global S&T leaders either increasing or stagnating.

Party officials and ministries most responsible for elevating

---

[78] For reference to the points made in this paragraph see Sangbae Kim and Jeffrey Hart's, "The Global Political Economy of Wintelism: A New Mode of Power and Governance in the Global Computer Industry," in James M. Rosenau and J. P. Singh, eds., *Information Technologies and Global Politics*, Albany: State University of New York Press, 2002.

China's position within the international order of the division of labor, for example the CCP, the Chinese State Council, the State Planning and Development Commission and MOST, will attempt to offset this dependency via lobbying for *techno-nationalist* S&T policy measures, including enforcement of technology standards favorable to domestic firms. Consider, for example, the widespread availability of pirated software, e.g. Microsoft's Windows. On the one hand, this has allowed Chinese firms and agencies to circumvent having to pay licensing fees; yet, perhaps ironically, it has also increased China's dependence on Wintel—so-called for the complementary Microsoft Windows products for operating software and Intel Corporations semiconductors for hardware. As a result, these ministries and policy makers are actively pushing coordinating with their Korean and Japanese counterparts to hasten the introduction of the freeware Linux based operating systems to end this dependence.

By contrast, China's entrance to the WTO in 2001 has further buffered interests within Chinese circles to adopt a *techno-globalist* S&T policy regime. China's WTO obligations hinder the state's ability to pursue domestic IT firm advancement via the traditional methods i.e. quotas, tariffs and closing off the domestic market from foreign competitors. The WTO's *Technical Barriers to Trade Agreement* includes provisions that member states not use technical regulations, standard barriers or conformity procedures as obstacles to market access by outside firms and nations (Provision E.) The TBT Agreement, further, calls for transparent standard setting practices, and, *to the greatest extent possible*, the use of technical standards approved by the International Standardization Organization (ISO) and other standard deciding bodies.

China, further, recently (2003) joined the Information Technology Agreement (ITA). The ITA deals solely with cutting tariffs among member nations who sign the Agreement. All tariffs on IT goods covered in the ITA Declaration must be reduced to zero, as must all additional duties and charges.[79]

Further, Stuttmeier and Yao[80] highlight the growing perception within China of a growing domestic capability to set innovative standards and develop new frontier technologies in relation to S&T policy. China's research and development expenditures ranked third in the world in 2002 (in purchasing power parity terms) behind only the US and Japan. Further, 810,000 scientists and engineers were active in private and government sectors (2002), and China now ranks within the top five nations in publishing papers in international science and technology journals.[81] This growing confidence in technological capabilities facilitates *techno-globalism* within Chinese S&T policy. Here, we would expect to see interested actors from MOST, domestic NGE, local officials and individuals from state think tanks, universities and research institutes with recourse in S&T policy arguing for a more *techno-global* line.

---

[79] Full text of the ITA Agreement available at: http://www.wto.org/english/tratop_e/inftec_e/itaintro_e.htm

[80] Ibid 15

[81] Figures from Ministry of Science and Technology, *China Science and*

Table 3: Forces Driving Bureaucratic Actors and Their Outcomes

Driving Factor	**Promotes Actors Who Support . . .**
Security concerns (global, regional, local	Techno-National interests
Domestic politics *(CCP, Nationalism and legitimacy*	Techno-National interests
Frustration over royalty payments (Tech. Dependency Fears)	Techno-National interests
WTO regulations	Techno-global interests
Budding technological confidence	Techno-global interests

The Chinese government keenly has pursued a technology policy regime beholden, in large part, to the state's interests as opposed to outside interests such as those of international organizations and firms. That is not to argue, however, that interests within Beijing's elite political circles and among bureaucratic and other interested parties has been static throughout the course of China's economic modernizations and reforms. It is hyperbole to argue that China was in the past patently *techno-nationalist* and is only now making the necessary overtures towards *a techno-globalism*, presumably as a result of failures in the

---

Technology Statistics: Data Book 2003, Beijing, 2003.

earlier policy line. To the contrary, the evolution of the state's policy course is testament to the waxing and waning in power of divergent bureaucratic interest groups in Chinese policy-making. What the research evidences is in the earlier eras (1980-90s) of the state's S&T development policy bureaucratic forces responsible for choosing policy courses *tended* towards a *techno-nationalism.* Bureaucratic actors within the Chinese political economy arguing for a more *techno-global* S&T policy line, however, have wielded enough influence to force a consensus of opinion regarding S&T policy. That said, all in all, Atushi's model goes far in capturing the tensions between the opposing course lines and characterizing the current S&T development policy China is employing (*neo techno-nationalism*).

Chapter IV- Modeling China's Pre-WTO Ascension S&T Development Policy Courses

State Owned Enterprises and the Development State —1980's

In the post-Mao era, China's marketization reforms occurred rapidly, transforming the grassroots economies—agriculture and labor-intensive low-value manufacturing, which where long mainstays of the Chinese Communist Party's ruling power. The reforms brought market prices to bear on former agricultural cooperatives, and decreases in central planning of the economy coincided with an increase in reliance on more open market signals to herald changes in the micro and macro economic policy. In the high-technology sectors however, Beijing tended towards the model used by both Korea and Japan in earlier decades to spawn competitive high-tech industries in areas where they may not enjoy a relative comparative advantage in the global political economy. Policymakers insisted that high-tech sectors were the most in need of direct government involvement with local and central governments wielding heavy-hands in the path of technology development.[82]

Among the tools governments use to turn "losers" into "winners" are tight controls on FDI, subsidizing key export industries,

[82] See Barry Naughton and Adam Segal's "Technology Development in the New Millennium: China in Search of a Workable Model," in William Keller and Richard Samuels, eds., *Crisis and Innovation: Asian Technology After the New Millennium*, New York: Cambridge University Press, 2003.

placing import restrictions on firms, and explicit guarantees for purchases. Naturally, this is done to the exclusion of foreign firms as that would contradict the stated purpose. Much of this work was done through the regulatory framework and the maintenance of the policy creation and enforcement networks outlined in the previous chapter. The Trademark Law (adopted 1982, amended 1993, updated 2001 and 2002), for example, gave *unequal* treatment to foreign trademarks and required all firms (domestic and foreign) to use Chinese legal firms to apply to register foreign trademarks. This penchant towards unrepentant *techno-nationalism* by this eras policymakers will become clearer given further elaboration on the specifics of China's S&T policy.

Beijing was keen to enjoy the production and technological sophistication gains brought to the nation's economy via technology transfers and increased employment but weary of the gains in market positions by multinational corporations (hereinafter MNC). Hence, the domestic market was tightly regulated via regulations, taxes and laws at both the local and central levels. Foreign-owned enterprises were, for the most part, denied access to the vast Chinese market and capital inflows were regulated to guide investors largely to export industries. Those foreign firms active in the domestic market were allowed access on condition that production required technologies the Chinese either did not have or the technological know-how to commercialize.

Early 1980s industrial plans, moreover, centered around the production and innovation capabilities of large sized SOE, which were mirrored largely on Korea's *chaebols*. Cordoning off the domestic market from foreign firms and giving it instead almost solely to state-

owned IT firms state planners thought would shield SOEs from international competition and, in turn, spawn their IT innovation and technological assimilation qualities. Policy makers relied on many of the tools employed by the Korean and Japanese in earlier decades, namely, sector-specific financial incentives, trade protection, and relaxed antitrust regulations. [83] These, however, were largely unsuccessful. Chinese IT firms failed to make real headway with respects to the mass commercialization of next generation technologies and what they did produce was often inferior in technical efficiency and productivity capability than foreign firms.

The result was the revamping of innovation networks and mass commercialization of technologies by policy leaders. In 1985, the Central Committee of the Chinese Communist Party introduced the landmark "Decision on Reform of the S&T Management System," which would revamp the state's S&T framework and advance the mass scale commercialization of IT.

> *"Modern science and technology constitute the most dynamic and decisive factors in the new productive forces . . . We should reform China's science and technology management system resolutely and step by step in accordance with the strategic principle that our economic construction rely on science and technology and that our scientific and technological work must be oriented to economic construction . . ."*
>
> --From the Decision on Reform of the S&T Management System, 1985

[83] Linden, Greg, "Optical Storage In China: A Study in Strategic Industrial Policy," a publication of the Information Storage Industry Center, Graduate School of International Relations and Pacific Studies, University of California, September, 2003

This “decision” was a watershed event in the trajectory of the state’s S&T development strategy. As a result, China’s S&T policy divided into two trajectories, which, ideally, were to be mutually reinforcing. The two trajectories were absorbing advanced technologies from abroad while developing the domestic technological capacity to assimilate, and in some cases recast, these technologies and innovate new S&T. The latter--technological assimilation and innovation—were tremendously important to policy crafters as the inroads made by domestic engineers and technicians would serve as the foundation for an innovative and globally competitive domestic production chain. To this end, the “decision” revamped the S&T innovation system, which previous to 1985 had devolved largely to SOE and research institutes working in conjunction with the PRC to modernize China’s warfare capabilities. While the military modernization efforts certainly resulted in increased PRC strength, few, if any, of the new technologies were brought to market for mass commercialization. And owing to the sensitive nature of these military technologies, it was unlikely that these developments would serve as decisive factors in the new productive forces. Hence, Beijing called on increased collaboration between universities, think tanks, research institutes and S&T firms, which in turn forced researchers military and otherwise, to openly compete for Beijing’s R&D funds.

The “decision” also marked the first tentative steps in Beijing’s giving greater decision-making and policy implementation roles to lower level cadres. This decentralization of policy allowed for regional economies within China to take greater advantage of their particularly favorable dynamics. Shanghai and its surrounding regions, for example,

had historically served as a center for China's heavy industries. With the decentralizing of IT policy, the region could attract foreign investors based on its existing industrial structures and oceanic pathways to Korea, Japan and the United States. Decentralization also freed state-owned enterprises to form joint ventures with MNC, ideally inducing S&T development.

The new policy line evidenced Chinese officials realization the centrally planned policy regime was inhibiting the introduction of new technologies to China and the development of domestic firms with the competent technology know-how to compete with the global production and innovation networks of the large MNC such as Philips, Samsung and Sony.

On the heels of the "decision" came the frontrunners of the state's long-term IT development programs. Although Beijing had given up some of its central control on IT development and innovation, it would still influence the development trajectory and speed in the IT sector via these plans. The programs also clearly marked the central party's intentions to accord it's powers as the state's dominating political body with the forces of the market. According to Kathleen Walsh, "these national programs were intended to guide China's scientific and research efforts away from the centrally planned, hierarchical, state-funded system and toward accelerated development of science and technology more responsive to China's industrial, commercial and military needs."[84]

---

[84]Kathleen Walsh "Foreign High-Tech R&D in China: Risks, Rewards and Implications for U.S.-China relations," a publication of the Henry L. Stimson Center, Washington, DC, 2003.

The list below names a few of the more salient programs as concerns IT sector development (all of these currently fall under the auspices of MOST):

- *Spark Program* (1986): This program sought to make advancements in China's agricultural sector via the introduction of new technologies. It also called for increased technical training for China's vast rural classes.

- *Program for Hi-Tech research and Development / The 863 Program* (1986): This program focuses on intensifying R&D efforts in eight strategic priorities sectors. The IT sector is included among these eight. A recurrent theme throughout this program is the emphasis on domestic innovation and commercialization of new technologies. It, perhaps more than any of the other programs, is the best representative of the techno-nationalist stream in China's political circles.

- *Torch Program* (1988): This program has focused on attracting and financing research and development ventures while also commercializing new technologies. Initial government investments under the Torch Plan totaled US$ $40 million. This figure later reached US$ 800 million by 1992.[85] The Torch Program also called for the building of high-tech "zones" modeled largely on the US's successes in Silicon Valley in California and Route 128 near Boston.

[85] Ibid 52 p. 17

(The two American high-tech "zones" have been hotbeds for IT production and innovation.) It also called for the establishment and financial backing of research institutes to be located in the zones. Enterprises operating within these zones are given preferential tax and loan rates.

- *National New Products Program* (1988): This program promises fiscal and regulatory support for R&D initiatives resulting in the introduction of new high-tech products provided at least 80 percent of the components are produced domestically, the new tech products have great export potential and are international standard compatible.

Even with these well-thought-out development plans, however, the proclivity of Chinese policy makers to rely on foreign enterprises for technology transfers while maintaining a tightly regulated planned central economy posed discrepancies. On the one hand, as the economy underwent the profound transformations of the early 1980s, China could exploit its vast and inexpensive labor force in attracting foreign companies. "Manufacturer to the world" status, however, was antithetical Beijing's long-term goal of becoming and IT powerhouse. Low wages and a comparatively poor (to US, EU and Japanese standards) technical infrastructure forced foreign firms to rely heavily on overseas technological know-how as the Chinese alternatives were either less- productive or less- sophisticated technically

And as China's fears of opening the domestic market to MNC's grew in pitch so to did the real possibility that China would be left far

behind in the global IT "revolution." A narrow *techno-nationalism* and a willingness to wait out the SOE's lengthy trial and error processes for bringing new technologies to market no longer served Beijing's mid to long-term economic interests.

Policy Shift: The Birth of the NGE

The 1990s saw China's IT policy regime move from the previous decades emphasis on SOE at the exclusion of MNC to a policy mode keen to support the works of domestic, smaller-scale non-governmental enterprises (hereinafter NGE) and incorporate them into the IT production chain. 1990s policy also allowed for greater labor flexibility and foreign investment into the domestic market. Large sums of FDI poured into the country during this period in hopes of securing access to the massive Chinese market.

Chinese policy makers also took note of the remarkable successes of the Guangdong region, which was able to attract large scale high-tech investments by capitalizing on its geographic proximity to Hong Kong and Taiwan. Export manufacturers from the two, Taiwan and Hong Kong, steadily moved into the region attracted by the ample supply of a low wage workforce and implicit support by local party officials. Accordingly, Beijing liberalized the investment regime in 1992-3. State planners were hoping to attract FDI by seducing MNC with China's distinct economic capital stock—a massive labor force and growing technological capacity. FDI figures under this policy regime speak to the efficacy Beijing had in attracting foreign investors.

Table 4: FDI in China Selected Years between 1979-1997

Year	Number of Projects Pledged	Value of Projects Actually Utilized ($US billion)
1979-82	922	1.77
1985	3,073	1.96
1988	5,945	3.74
1991	12,978	4.37
1992	48,764	11.00
1993	**83,000**	**27.52**
1994	**47,490**	**33.79**
1997	**21,046**	**42.28**

Source: Chinese Ministry of Foreign Trade and Economic Cooperation (MOFTEC) figures

The early 1990s heralded more progressive, market conforming overtures by central authorities. In 1993, Beijing announced the "Decision on Several Problems Facing the Enthusiastic Promotion of Non-governmental Technology Enterprises." Much as the name suggests, the "Decision" called for a greater role for non-governmental enterprises in the innovation and commercialization of new technologies and systems. (These NGE have been so important to the development of China's IT sector that we have devoted a section to these NGE alone. This has been added in the section immediately following.)

Following on its heels was the CCP Central Committee and State Council's "Decision on Accelerating Science and Technology Development (1995)." This 'decision' heralded further reforms in S&T policy, though none so drastic as a decade earlier when central

authorities radically reformed existing policy structures; rather, these reforms built on existing S&T programs. As such, this 1995 “decision” earmarked some rather practical methods by which central planners hoped to induce greater growth in the S&T sector in general and the IT sector in particular. It also signaled Beijing’s underlying political intentions.

To begin, the ‘decision’ encouraged domestic firms to create joint ventures with foreign firms. Domestic firms, originally skeptical of the new position, warmed to MNC in the market, as they were also able to capitalize on increased FDI inflows. Many NGE were unable to loosen the central bank’s coffers and, as such, had difficulty in winning the necessary capital to cover their balance sheets. The capital stocks, technology transfers and know-how these domestic firms stood to gain in return for joint partnership with foreign firms, moreover, promised to advance domestic firms production and innovation capabilities.

It earmarked increased spending on S&T—the upward limit being set at 1.5 percent of GDP by 2000 and explicitly reiterated Beijing’s wish to increase the number of domestic innovations marketable in both the international political economy and in China’s own market. The language in the “decision” is marked by inferences to ‘leapfrogging’ stages of technological growth in an effort to “catch-up” with the technology levels of advanced economies. (In keeping with the theme of characterizing Chinese policy, for all the pragmatism weaved throughout these policies, the underlying impetus, catching-up to rival economies, remained a consistent paradigm helping driving forward the evolution of S&T policy.)

This ‘decision’ also marked Beijing’s emphasis on upgrading China’s human capital via increases in educational and training levels.[86] This took the following forms: 1) educational commitments in the form of colleges dedicated to science and technologies and increased quota numbers for the number of newly entering students; 2) financial commitments to support such colleges; 3) the political commitment to legislatively support the creation of a new knowledge workforce; and finally 4) support a research and development structure to employ the newly-minted graduates

Finally, it called for greater intellectual and production autonomy for research institutes. This latter call for greater autonomy was a maneuver to further decentralize the nation’s innovation system, which had been lagging in comparison with IT international counterparts. Innovation systems are *sine qua non* to well functioning and dynamic IT sectors.

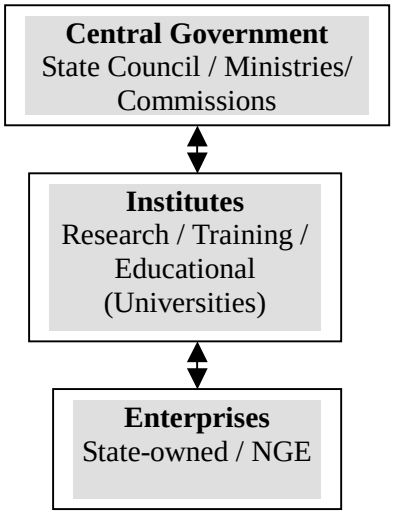
The working definition of a national innovation and coordination system (NSI) used here refers to “a set of functioning institutions, organizations and policies that interact constructively in the pursuit of a common set of social and economic goals and objectives and that use the introduction of innovation as the key promoter of change.”[87]

---

[86] During the Mao-era, the economy had been geared towards maintaining agricultural predominance. Intellectuals were mistrusted; and, as a result, the scholarly disciplines saw dramatic shrinks in their numbers.

[87] From "A Decade of Reform: Science and Technology Policy in China" (Ottawa, Canada: IDRC, December 1997) as quoted in Kathleen Walsh’s, “Foreign High-Tech R$D in China: Risks, Rewards and Implications for U.S.-China relations,” (Henry L. Stimson Center, Washington, DC, 2003) p. 49.

Figure 6: PRC National Innovation and Coordination System



Source: My own formation adapted from a model by Kathleen Walsh.

In terms of institutional development, Beijing founded the National Engineering Research Centers (NERC) in 1992. The driving purpose behind the creation of these centers was to "link (or spin-off) research conducted by CAS-affiliated research institutes to manufacturing processes and production."[88] The NERC were meant primarily for links in high priority sectors including information technologies, telecommunications and medicine to name just a few.

Like the CAS, sponsorship and oversight of the NERC belongs to the Ministry of Science and Technology—further sign of Beijing's abilities to reach deeply into the IT sector. NERC are given responsibility to hasten the process of introducing new technologies; however, funding is provided to these NERC only for their first three years after which they must meet state development markers to receive

additional funds. Those that chronically fail to meet the standards will lose their NERC designation as well as their state funding.[89] In the mid-1990s, China also authorized the establishment of wholly foreign-owned enterprises (WFOE).

On the heels of these earlier "decisions," in 1999, the State Council announced the "Decision for Increasing Domestic High-Tech Industries and Services." This called directly for:[90]

- A fund to support S&T innovation by small and medium sized enterprises;
- Preference for domestic high-tech products and equipment in government and enterprise procurement;
- A tax exemption for all income from the transfer of new technologies and related consulting and technical services;
- A preferential 6-percent value-added tax rate for software products developed and produced in China;
- Complete deductibility of payroll expenditures for software development and manufacturing companies;
- Complete VAT exemption and subsidized credit for high-tech exports;
- Preferential tax treatment for imports of cutting –edge technologies and equipment not available in China;
- Listing new high-tech companies on the Shanghai and Shenzen stock exchanges.

Regarding changes in China's S&T law and regulatory framework, in 1999, the State Council issued the "Law on Promoting the Transformation of S&T Results" and the "Science and Technology Progress Law" which, as the names suggest "encourages

---

[88] Ibid p. 50

[89] The information regarding NERC borrows heavily from Walsh's paper

[90] The list below comes directly from Barry Naughton and Adam Segal's "Technology Development in the New Millennium: China in Search of a Workable Model," in William Keller and Richard Samuels, eds., *Crisis and Innovation: Asian Technology After the New Millennium*, New York: Cambridge University Press, 2003, p. 17.

research institutes, universities, and their researchers to transfer their new/high-tech results in different forms and create high-tech firms."[91] According to the regulations within these, no less than 20% of the net revenues resulting from technology transfers go directly to the transferring researcher or research group.

While this era in S&T development policy was marked by genuine 'advancement' as regards innovation, regulatory and legal frameworks meant to aid IT sector development, the reforms, however, were not a *panacea.* China's poor record of protecting intellectual property rights and the government's unwillingness to protect foreign intellectual interests at the expense of domestic enterprises retarded outside firms willingness to share technologies. Cases of Chinese partners transferring high technology to domestic firms or simply reverse engineering high tech transfers abound in earlier eras of development. Secondly, via taxes and regulations regimes, Beijing made explicit its wish that foreign invested enterprises (FIE) export their goods while transferring in the necessary production technologies and importing inputs. Accordingly, Beijing adopted a policy regime whereby the import of inputs could enter China duty free provided that the finished product was exported. Such a policy was intended to attract firms to move their production and research operations to mainland China.[92] And it was successful in an absolute sense in getting foreign firms to relocate. This policy, however, had real negative externalities.

---

[91] From the Chinese State Council's, "Law on Promoting the Transformation of S&T Results," 1999.

[92] Trade regime implications from Barry Naughton and Adam Segal's "Technology Development in the New Millennium: China in Search of a Workable Model," in William Keller and Richard Samuels, eds., *Crisis and Innovation: Asian Technology After the New Millennium,* New York:

Naughton and Segal[93] point to the example of the Hard Disk Drive (HDD) Industry to drive home how the interaction between practice and this policy had deleterious effects on Chinese firms advancement. Nearly all HDD plants in China are foreign owned or joint ventures. These firms accounted for 10 percent of the global HDD output in 1998. Manufacturing these HDD is organized by part according to labor intensiveness and component inputs. All of the necessary components to construct the drives are imported. Ironically, throughout the 1990s, 100 percent of these HDD were exported to overseas markets despite the fact many of these drives later were installed into PCs in China via purchase from international sellers.[94]

Chinese trade policy doomed domestic suppliers of HDD parts unnecessarily to smaller market shares and Chinese consumers, and for that matter global HDD consumers, to potentially higher prices than would have been otherwise necessary had the Chinese policy regime allowed foreign-owned and joint venture firms a) more direct access to the local market and b) to rely more heavily on local firms for parts supply. Moreover, the policy encouraged FIE to remain wholly within the supply links of overseas firms rather than cultivating ties with Chinese firms, firms who were often able to produce the intermediate parts needed for production at lower costs than foreign suppliers.

It then comes as little surprise, though contrary to what many scholars, economists and planners, assume, that according to Chinese industry officials and heads, in the 1990's technology spillovers in China were "quite modest or non-existent."[95]

Cambridge University Press, 2003.

[93] *Ibid* 8 p. 9

[94] *Ibid p. 12*

NGE in the Economy

Private high-tech enterprises in China's capital city have become the pillar of economy" [96]

---China People's Daily headline

23 October 2000

In the past two decades the influence and number of non-governmental enterprises (NGE) operating within the Chinese economy has increased exponentially, and analysts estimate this figure will continue upward as China's economy grows (assuming it does, of course).[97][98] Private analysts now estimate that China's NGE are nearly of equal importance in GDP contribution to the state sector[99]--in 2003 China's total GDP was- $6.449 trillion (in PPP terms), meaning private enterprises accounted for slightly over $US 3 trillion. [100] Since the early 1980s, private sector growth has averaged 71 percent per year in terms of output and 41 per cent in terms of new employment.

The growth of NGE (Chinese: *minying*) comes on the heels of the addition of Jiang Zemin's "Three Represents[101]" theory into the

---

[95] Ibid p. 13

[96] "Private High-Tech Enterprises Become Pillar of Economy in Beijing," from the People's Daily English version, October 23, 2000 available at http://english.people.com.cn/english/200010/23/eng20001023_53329.html

[97] The Chinese equivalent for NGE is *minying*

[98] Adam Segal. *Digital Dragons: High-Technology Enterprises in China*. Ithaca and London, Cornell University Press, 2000.

[99]The analyst referred to here is Mr. Assaad Jabre, Vice President, Investment Operations, International Finance Corporation. View taken from his speech at the "Launch Ceremony of China's Emerging Private Enterprises," October 18, 2000 Beijing.

[100] Figures from the US CIA Factbook (2004) http://www.cia.gov/cia/publications/factbook/geos/ch.html

[101] For an English interpretation of the "Three Represents" direct from Chinese government sources see

Chinese Constitution. Previous Chinese leaders, Mao Tsetung and Deng Xaoping outlawed private capital and banned private entrepreneurs from official CCP membership during their tenures as head of the CCP. The "Three Represents," by contrast, legitimizes the CCP's incorporation of private entrepreneurs and capitalist into the leagues of the communist party.

Minying is a nebulous concept and, admittedly, there is a certain ambiguity in their characterization. Segal defines *minying* enterprises as "enterprises staffed by individuals who understood technological development and were free from outside interference."[102] He goes on to argue that *minying* enterprises "were responsible for their own development, organization, financing and all profits and losses."[103]

Segal's definition is an accurate characterization of the *minying* enterprises. Indeed, China's NGE are comparable in many ways to private actors in more advanced western countries where directors and innovators rely primarily on market forces to dictate future courses. However, we would like to include some additional considerations in search of a working definition. The tight control the CCP maintains over the means of production and capital in the economy allows Beijing to *selectively* pick those firms to whom it allows NGE status. And, by extension then, it gives Beijing the same power to rescind the licenses of firms who may operate in ways incompatible with Beijing's political and economic interests. Hence, these NGE cannot be considered entirely "private" firms in the ideal western sense. As a Chinese official noted, "our definition of nongovernmental is not equivalent to what they call 'private' in other countries. Our 'nongovernmental' has public

---

http://www.idcpc.org.cn/english/policy/3represents.htm

[102] Ibid 67 p. 41

[103] Ibid p. 41

ownership as the main part."[104] Accordingly, it is not altogether uncommon for a *minying* to be state-owned. For purposes here, *minying* enterprises lay somewhere in the middle of the continuum between wholly private and wholly public.

In keeping with the decentralization of policy creation and economic oversight, government support for *minying* enterprises in the IT sector has varied dependent on region. Hence, the development patterns of *minying* enterprises followed differing trajectories according to the interplay between local governments and China's national S&T policy.

[104] Ibid p. 40

Table 5: Types of Local Government Support

	Beijing	**Shanghai**	**Guangzhou**	**Xi'an**
	Science based, research institutes	Labs within SOEs	Basic infrastructure	Science based, research institutes
I) Investment				
	Loans, FDI to *minying* enterprises	Loans, FDI funneled to SOEs	Only FDI to small collective private enterprises	Loans to SOEs, very limited FDI
II) Property Rights	Multiple forms of ownership	Limited stock companies for SOEs; large groups	Collective than private	SOEs, limited stock companies
III)Government Supervision				
a)Market activities	Horizontal	Vertical ties; large groups	Hands off	Horizontal and vertical
b) Political Activities	*Minying* enterprises at center of technological development	*Minying* as complement to SOEs	All private	Between being at center and being a complement to SOE

Source: Adam Segal. *Digital Dragons: High-Technology Enterprises in China*. Ithaca and London, Cornell University Publishers, 2000 p. 16.

In Beijing, which is home to China's version of the US' Silicon valley, the number of NGE grew from 520 in 1987 to 2100 in 1990—nearly four-fold. Beijing's *minying* enterprises tended to hybrid ownership structures with private actors working in conjunction with government officials. In particular, these enterprises have had tight links with supervisory agencies headquartered in the capital city. Managerial authority has remained in the hands of those entrepreneurs who founded

the enterprise.[105]

Development patterns for *minying* enterprises in Shanghai, by comparison, contrast markedly with those in Beijing. The state owns the large majority of *minying* enterprises in Shanghai with managerial decision-making devolving to local and regional bureaucrats. In Xi'an the relationship has characteristics reminiscent of the practices in those of both Beijing and Shanghai. *Minying* enterprises are both state-owned and private government ventures, respectively. Managerial control of the enterprise falls to both local and regional bureaucrats as well as the original entrepreneurs with state officials playing highly active roles in charting the course for IT development.[106]

Finally, in the Guangzhou region we find *minying* enterprises that bear the most marked resemblance to their western peers. Ownership in Gunagzhou's *minying* enterprises is held for private partners solely with managerial authority and course development being decided solely by the individual directors. Moreover, state meddling in the enterprise is very limited and nearly non-existent in most cases. Additionally, the state's explicit financial support for Guanzhou's *minying* enterprises is very limited whereas the state's financial commitments to Beijing, Shanghai and Xi'an's *minying* enterprises are considerable.[107]

---

[105] The degree of autonomy for these firms, however, has increased with time and, concomitantly, the role of the supervisory agencies in the actual innovation and marketing processes has withered.

[106] See Adam Segal's *Digital Dragons: High-Technology Enterprises in China*. Ithaca and London, Cornell University Publishers, 2000 pgs. 17-20.

[107] For more in-depth analysis see Ibid pgs. 51-120.

Box. 1 Lenovo Corporation

The Lenovo Corporation (formerly Legend Corp.) is a telling example of a successful NGE spun-off from state research institutes. A group of scholars and engineers from the Chinese Academy of Sciences founded Legend in 1984 with initial start-up capital of 200,000 RMB. In 1988, Legend introduced its first PC to the domestic market. From 1993-97, Legends annual income skyrocketed from US$ 500 million to US$ 1. 5 billion--three times greater. Moreover, in the mid-1990's Legend's PC's were outselling domestic and foreign competitors alike domestically. And in 2000, the Chinese government granted Legend "non-governmental" status, permitting it to sell shares to private holders. In December of 2004, the newly minted Lenovo Corporation purchased the PC manufacturing arm of IBM.

Chapter V – China Joins the World: China's S&T Development Policy post-WTO Ascension

"*The next five to ten years will be a very important period for China's economic and social development as well as IT economic restructuring," he said. "In some key areas relating to the overall development of the national economy, we must pay special attention to the development of hi-tech industries and try to realize surging growth of these area"*

--former Chinese Vice-Premier Li Lanqing
November 2001

Underlying China's current technology policy regime is a genuine wish to turn China from a large IT player into an IT powerhouse—a setter of technological standards rather than a "fast follower." China's post-WTO ascension technology policy aims to couple the positive externalities of protecting China's domestic IT industries i.e. *techno-nationalism* while nurturing the relative benefits to China's IT industries afforded by a *techno-globalist* approach to the international political economy.

In 2002, the Ministry of Science and Technology declared the following factors critical to China's S&T policy in the *post*-WTO ascension era:

1) *Increases in research and development spending.* R&D expenditures increased from 0.64 percent of GDP in 1997 to 1.23 percent in 2002.[108] Among the areas the ministry will concentrate on are: super scale integrated circuits, computer software, information security systems, e-finance, electric automobiles, functional gene chips, and the establishment of key technical standards.

[108] PRC's Ministry of Science and Technology, 2003.

2) *Intellectual Property Rights*. This is not surprising as China is obligated under WTO rules to strengthen property rights protection. As Stuttmeier and Yao note however,[109] Beijing will consider Chinese innovators first and foremost in it's property rights protection scheme while "incorporat[ing] a sharper focus on the management of intellectual property for China's benefit in national research and development programs." Interestingly, the government has also begun pooling patents from domestic agencies and R&D institutes with those of foreign firms and governments to further the position of domestic IP standards.[110]
3) *Human Resources.* Human knowledge is a core requirement in the advancement of China's technological production and innovation capabilities. To this end, Chinese authorities will launch campaigns to increase domestic know-how via education and enervate efforts to lure back scientists and engineers lost to overseas firms.
4) *Standards Based Focus.* The new policy line calls for endogenizing technical standard decisions especially in IT. *The crux lay in whether or not Beijing pursues such a policy in accordance with both the spirit and the letter of IT WTO obligations.*

Observers will recognize the commonsense in Beijing's approach—it is a standard formula for technology development in planned economies. As one South Korean government official

---

[109] See Richard P Suttmeier,. and Yao Xiangkui, " China's Post-WTO Technology Policy: Standards, Software, and the Changing Nature of Techno-Nationalism," a special report of the National Bureau of Asian Research, Seattle, No. 7, May, 2004

[110] For a discussion of this see Greg Linden's "Optical Storage In China: A Study in Strategic Industrial Policy."

noted,[111]increased R&D expenditures amount to little more than "wastes of precious money" if the funds are not matched by qualified technical know-how i.e. human knowledge. The two must keep pace with each other; the work of policy officials then lies in preserving the equilibrium between money and talent. In the years between 1995-2000, Beijing more than doubled its expenditures on R&D. In terms of China's gross expenditure on R&D (GERD), the number jumped from RMB 34.9 billion in 1995 to RMB 89.6 billion in 2000—nearly a 60 percent increase.[112] This is obviously a reflection of Beijing's genuine commitment to developing China's S&T capabilities.

Beijing has a goal of maintaining science and technology R&D expenditures at 1.5 percent of GRED. The amount for R&D allotted in 2000 fell below this goal, marking only 1 percent of GRED. This is equal or above the same figure for developing economies, however, well below the averages for advanced economies. Japan and Korea's, for example, annual R&D figures average 2.5 percent (GRED.) We, therefore, can expect to see these figures grow as China continues its rapid economic development and restructuring process.

Beijing is keen to have the large majority of its R&D funds spent on technology development rather than research. Walsh argues this owes to Beijing's continuing to "pressure" researchers and developers to look for funds outside of state coffers.[113] This pension for spending on technology development rather at the expense of funding research,

---

[111] Personal interview 10/05/2004 with Dr. Jong-sung Hwang, Vice-President of South Korea's National Computerization Agency, IT Policy Bureau.

[112] Figures from the Ministry of Science and Technology

[113] Kathleen Walsh's, "Foreign High-Tech R$D in China: Risks, Rewards and Implications for U.S.-China relations," (Henry L. Stimson Center, Washington,

however, does not mean that the state has washed IT hands of research *en masse*. As Walsh aptly points out, the R&D budgets for China's National Science Foundation Center and the Chinese Academy of Sciences have increased largely since the mid-1990s.[114]

Table 6 : PRC Spending on R&D

	State R&D Expenditures (RMB Billion)	**Percent of Total R&D Spending**
Basic Research	5.2	5%
Applied Research	17.6	16.9%
Technology Development	81.4	78.1%

Source: Kathleen Walsh, see footnote.

In terms of the state's direct spending on S&T, Beijing earmarked RMB 70.3 billion (US$8.5 billion) for science and technology expenditures while helping private financiers and venturers raise RMB 258.9 billion in 2001—a nearly 10 percent increase from the previous years figure.

Turning now to state development plans and targets for the new millennium, in the 2001 update of the "863 Program," MOST laid out its ten-year plan targeting: compute software and hardware technology, communication technology, information acquisition and processing technology, and information security technology.[115]

In the computer software and hardware technology sector, the emphasis is on *domestic* development of core technologies to provide the needed technical infrastructure for China's "boom" in technological innovation. In 2001, the government had approved support for 179

DC, 2003) p. 51

[114] Ibid p. 64

[115] "Annual Report of the National High Technology Research and Development Program of China" (863 Program), 2001.

projects (public and private). The Han Wang online Chinese character recognition system and a first run prototype for an on-line education and e-government system were the most notable achievements in this sector.[116]

In the communication technology sector, government officials and planners turned their attention to developing the next generation broad-band information network and communication systems "*with our own intellectual property rights*." The government had approved 45 projects in this sector. Notably, the "3rd Generation Mobile Communication System" was able to develop a working system able to incorporate the three dominant communication technology standards, TD-SCDMA, WCDMA and CDMA2000, and a consortium of private and government researchers were successful in developing a 32 x 10 gigabyte wavelength multiplexing system.

The government's aim in the information acquisition and processing technology sector is to further develop the country's information infrastructure via absorption and innovation of high resolution and multi-dimensional/spatial technologies. The construction of technologically advanced satellites into orbit for navigation, and arguably, intelligence purposes comes under this rubric. As an interesting note, when Colonel Yang Liwei returned from his successful mission into space, the Chinese government took out a trademark on the Colonel.[117] Of all the sections the government is focusing its energies in spawning, this is the most politically sensitive as advances by the People's Republic of China to gather information on geo-political

---

[116] Ibid
[117] From an article in BBC news December 9, 2003 http://news.bbc.co.uk

competitors raises the stakes in a region, north-east Asia, already beset by a litany of budding and active conflicts.

Finally, in the information security technologies sector, the goal is to secure the core technologies necessary to build the security architecture to protect China's information. 51 projects had met government approval in 2001, resulting in a host of patented core information technology products.

The latest update of the Spark Programme (2000) came before China's ascension to the WTO; however, the body of the policy remains intact.[118]

- New/high-tech enterprises established in one of Chinas 'tech development zones' will have their tax rates reduced by 15 percent;
- Those new/high-tech enterprises whose output value of exports reaches 70 percent of the firms total output for the year will be taxed at a rate 10 percent below expected;
- New/high tech enterprises in these development zones can be exempted form income tax within in the post-WTO era provided approval of the relevant state tax authorities approval.

The Chinese government, further, plans to help finance these high-tech ventures by allowing for 'special loans for S&T development' and giving Spark projects fiscal support from the New Product Programme budget and from the Chinese Torch Foundation and the Chinese Scientific and Technological Development Foundation.[119] The government is expecting to realize a total annual income of 600

---

[118] From the Chinese Ministry of Science and Technology, *Spark Programme*, http://www.most.gov.cn/English/Programs/Spark/menu.htm
[119] Ibid

billion Yuan ($US 72 billion) from technological development, industrial production and trade, in which 500 billion Yuan ($US 60 billion) will come form the sale of new/high tech products.[120]

In addition to the programs listed, the Chinese government will continue to revamp existing S&T development projects and create new ones when necessary in efforts to achieve Beijing's S&T development goals. One final notable example of the modes Beijing is employing to foster domestic high-tech industries was the State Council's approval in June 2000 of an 'Innovation Fund." This fund will support projects who show regard for intellectual property rights, advance technology innovation and introduction, and have good prospects for high sales of these products on the international IT market. In a nod to the importance of overseas Chinese and to soften China's losses from 'brain drain, the fund will also support newly-established ventures run by returned overseas Chinese students. In 2001, the State council earmarked one billion Yuan ($US 120 million) for the 'Innovation Fund.' In the same year, MOST and MOF approved 1,281 projects for sponsorship.[121]

In 2001, the State Council announced the 'Decision on Amendments to the Implementation Rules of the Law on Wholly Foreign-Owned Enterprises.' This regulatory amendment goes far to free WFOE from the former non-competitive provisions in the earlier rules regarding their participation in the economy. With this, Beijing has eliminated the requirements on WFOE regarding technology transfers, export quotas and domestic content use.

---

[120] Ibid

[121] Details regarding this 'Innovation Fund' taken from an article in the June 27, 2000 edition of the Chinese People's Daily.

Regarding intellectual property (IP) rights, Beijing has taken several opportunities to signal to the market its intention to reform its current regulatory framework on respecting IP rights. MOST issued its "Suggestions on Enhancing the Protection and Management of S&T-related Intellectual Properties" (2001), which proposes measures to steadily readjust the policies on IP ownership of new S&T. Under this guideline, with the exception of S&T results that relate to vital national interests, national security and public interests, advances in S&T made in execution with national S&T programs fall to the ownership of the individual, group, etc. . . that developed the technology.[122]

Buffering this was the third revised version of the “Chinese Patent Law”, which came into effect on July 1, 2001.Among the more notable revisions in this version were: 1) it clarifies that in applying for and granting a patent, SOE share the same rights and obligations as that of economic entities under other ownership; 2) it makes reasonable definition on a service invention-creation and legally provides that the inventor or creator of the service invention-creation shall be financially compensated; 3) it improves upon existing judicial and administrative operations related to patent and patent protection so as to further enhance protection for patent rights; 4) it simplifies and improves the patent approval and maintenance procedures, and safeguards the legal interests of the interested parties; 5) it has brought China's Patent Law in line with the terms required within the WTO’s trade-related aspects of intellectual property rights (TRIPS); 6) it sets explicit requirements

[122] Regulatory details taken from sources connected to the Chinese Ministry of Foreign Affairs home, available at http://www.chinaembassy.org

for patent approval and management agencies.[123]

Interestingly, Beijing's new signals towards greater respect for IP rights can help fuel increases in both domestic S&T research and inflows of high-tech FDI. As we noted earlier, however, how effective the new IP rights laws are in decreasing China's well-known levels of pirating technologies remains to be seen. At the time of this work (2004), it is too early to say a) how strictly these laws are being enforced, and b) whether Beijing is actively circumventing the letter of the WTO's TRIPS by showing preferential treatment towards IP and patent protection for domestic firms.

With these specific policy and regulatory measures in mind, we return to discussion regarding competing policy paradigms among China's bureaucratic ranks for a more holistic understanding of what China's IT industrial policy will look like in the post-WTO ascension era. China is genuine about its efforts towards reform; questions remain, however, as to the extent to which China is willing to pursue the course towards an actual 'open and free' market.

In Atushi's model, *neo techno-nationalism* consists of four definitive practices: 1) expanded state commitments in promoting domestic technological innovation; 2) a greater reliance on private actors and the co-mingling of public and private initiatives; 3) increased openness to foreign firms and influence; and 4) increased chances for cooperation and conflict among states. As for the *first*, the paragraphs above have pointed out time and time again how the Chinese state has "expanded its commitments to promote domestic technological

[123] The above details of the revisions taken from same source as previous footnote http://www.chinaembassy.org

innovation." This has come in the form of reinvigorating the innovation and implementation of domestic IT via financial incentives inherent within the regulatory framework such as favorable tax structures for domestic IT exporters. Further along this line, Suttmeier and Yao accurately point to the *strengthening* of China's technology standards policy as a response by Beijing's policy makers to combat domestic weakness in the IT sector and as a feasible way to circumvent the active letter of WTO requirements.[124] Hence, China is highly active within the international political economy to win international standard status for a variety of domestic IT innovations, in many cases regardless of existing *de facto* global standards. For example, Chinese officials have been lobbying hard that domestic companies need produce information security technologies as technologies built by foreign suppliers in the highly sensitive security sector put China at a greater risk of espionage. (The recent case involving WLAN standards in China given later in the case study is highly educational in this regard.)

Beijing's commitments to promote China's domestic technology industries will increase as the importance of the IT sector to the local, regional and international economies grows in scale. It is safe to assume that Beijing's commitments will grow in proportion with the IT sector's overall growth. Yet, the enigmatic nature of the Chinese economy--being a historically centrally-planned Marxist economy making overtures towards western free-market styled reforms--means that global IT markets will share influence on China's domestic sectors with domestic state actors in regards to product cycles and innovation and regional and global division of labors. That is, expanded state

[124] Ibid p. 10

commitments will influence these same domestic markets.

As regards the *second--a greater reliance on private actors and the co-mingling of public and private initiatives*—the incorporation of NGE into the traditional Chinese economy's folds and the revamping of the NSI framework exemplify this "reliance and co-mingling" on the part of the Chinese state. The Chinese political economy, however, dictates we temper the degree to which we assume the government will rely greater on private actors. As we discussed earlier in the section regarding NGE, the resultant abstraction in defining 'private actors' in the Chinese economy make qualifying empirically this characteristic of Atushi's *neo techno-nationalist* model a difficult task. As a result, it would be prudent to show a note of skepticism to works offering definitive statistics affirming the 'greater reliance on private actors.' That said, China has made real strides in the last twenty years in freeing both state-owned and non-governmental S&T enterprises from traditional state price, production and innovation constraints. As such, if we wish to limit our definition of private actors to enterprises who are more or less free from the typical Marxist-style planning i.e. price controls, strict central government enforced manufacturing qoutas, then, Chinese NGE and many SOE IT enterprises would satisfy this criterion. The issue we are raising centers more on the semantics surrounding the definition of a 'private actor' in the Chinese economy than it does increased roles for non-government enterprises.

The last two—*increased openness to foreign firms and influence and increased chances for conflict and cooperation among states*—need to be considered in conjunction with each other as they are

mutually reinforcing in China's case. More simply, we may consider the coming on the scene of one *the cause* that, in turn, gives rise to the *effect*, e.g. increased cooperation between China and partner states in S&T development would logically give rise to China's increased openness to firms from these partner states; conversely, China's opening of the domestic IT market to foreign firms will in time increase chances for conflict, owing to the competitive nature of the industry.

In approaching China's current technology policy regime, we, however, can neither underestimate China's willingness to engage the world on the world's terms nor underestimate China's desire to leverage it's political and economic strength to tip the balance of the international technology economy in its favor. China's particular concerns may change with time, say for example, as China develops competing technologies and wins greater recognition as a standards maker, domestic technologies may make inroads in larger sectors of the IT sector. As the Chinese government continues to further develop it's IT sector, chances for conflicts with other technologically advanced nations will rise as competition for markets heats up. For example, cooperation among China's strategic global partners, including the US and Japan, will increase as China advances through successive phases of IT introduction. China will also look to European technologies and scientists for collaboration, provided cooperation produces greater benefits than costs. Naturally, owing to the nation's particular domestic politics, central figures in the Chinese Communist Party will weigh the costs and benefits of increased interaction with foreign partners.

Case Study: China and WLAN Standards

In 2003, China announced that beginning on December 1 of that year, it would no longer allow the import, manufacture or sales of technologies that did not meet its own Wired Authentication and Privacy Infrastructure (WAPI) standard. The Standardization Administration of China, with the Ministry of Information Industry's go ahead, adopted the standard "*partly* due to a flaw in information security under the international standard."[125] The Chinese standard is similar to the IEEE 802.11 standard dominate in the US, Europe and Japan; however, China's WAPI, also called GB15629.11-2003, uses a *different* security protocol. WAPI was to be used in all technologies with Wi-Fi capabilities.

The Administration did leave a policy loophole giving a grace period for those products imported into China before December 1—these, in turn, would not have to support WAPI until June 1, 2004. Further, ever conscious of IT position in the international political economy, Chinese authorities did not require that products exported from China use WAPI.

Tellingly, Chinese computer scientists developed the new algorithms in the WAPI standard. And the Chinese government was the sole proprietor of these algorithms, meaning it could control who had access to the algorithms. In line with the neo techno-nationalist tendencies of the current regime, Beijing licensed use of the algorithms to 24 Chinese companies. Foreign companies wishing to sell or

[125] From "China Plans IT Own WLAN," Shanghai Daily, February 4, 2004.

manufacture units for domestic consumption would be required to enter into co-production agreements with one of these 24 Chinese companies.

International response, to the new WAPI requirements was pointedly negative. U.S. Secretary of Commerce Donald Evans, U.S. Secretary of State Colin Powell and U.S. Trade Representative Robert Zoellick, sent a formal letter to Chinese Vice Premiers Wu Yi and Zeng Peiyan expressing *concern* over China's implementing the new standard. US officials argued Beijing's move set dangerous precedent for using standards as a barrier to international trade.

Chinese authorities were using a provision in the WTO trade regime allowing for states to set standards different from prevailing international standards if they deemed in "national security matters" to justify their not obeying the spirit, if not the letter, of their WTO agreements. No formal charges against adapting the new standard were ever brought to the WTO; however, Beijing relented to foreign pressure (When exactly), announcing it would not opt for the new WAPI system.

Prior to this announcement, China had accepted the international standard for WLAN security as IT own. What precipitated the sudden shift in position then? The answer to this question is both economic and political. According to analyst estimates, sales in the wireless LAN equipment market size totaled roughly US$38.14 million (350 million Yuan) last year.[126] The size of this market is expected to grow considerably as the wireless technologies market is nowhere near IT market saturation point. Considerable sums of money stand to be

[126] From "China Plans It's Own WLAN," Shanghai Daily, February 4, 2004

made by making inroads into China's wireless technology market.

The WAPI case is an excellent example of China's using standards to a) spur growth for domestic corporations at the expense of foreign firms; and b) attempt to alter international standards by adopting a domestic standard incompatible with current standards. Chinese officials were banking on the fact that foreign firms would adapt to the standard out of sheer desire for continued access to the Chinese market; or put another way, that they would acquiesce to the new standard in China for fear of being left out of the Chinese market. Also, politically, enforcing a Chinese created wireless security standard would signal to both markets and states China's willingness to leverage it's mass and markets to increase it's stake in international standardization regimes

Chapter VI - Conclusion and Implications

Throughout this work, we have tried to paint a coherent picture of the Chinese S&T development canvass. Admittedly, the political economy approach to Chinese S&T development requires us to use broad strokes within an already complex bureaucratic and economic framework. We have taken a 'middle-of-the-road' position, so to speak, offering a vision of Chinese S&T development policy and policy-making that neither overemphasizes the role of outside forces nor treats as static the lengths to which the Chinese state is helping China's S&T development trajectory. For those in line with the former, the natural conclusion is that reforms in China's S&T policies and policy-making procedures are effects largely of a single cause: pressures from international markets and trade regimes; while those in the latter have tended to make much ado of the particularly 'closed nature' of China's political decision-making, relative to international 'best' standards, and state led construction programs to account for advances in China's IT sector.

To an extent both of these approaches captures some part of the entire S&T development policy 'picture.' As a whole, however, they miss the target, largely owing to misguided assumptions of the rather peculiarly progressive behavior of the Chinese state. Undoubtedly, China has taken large steps towards opening its economy as a whole and it's IT sector in particular That said, we cannot be entirely convinced that changes in China's S&T development policy regimes owe merely to

China's acquiescing to pressures to 'liberalize' or the 'superiority' of western economic principles. As the research in this work points out, every alteration, reform, etc . . . within China's S&T development policies has come only after a great deal of calculation and politicking within China's domestic political machinery. *In this sense, then, the state merely altered its behavior within the market rather than conformed to the market*. Chinese central authorities still retain strong control of China's S&T development trajectory, though increasingly less so.

Regarding the latter perspective, which emphasizes state-led development programs carried out often at the expense of international 'best practice' standards, indeed, separating the state from China's IT sector development is errant. This is not to argue, however, that the state's role has been consistently homogenous and ubiquitous. To the contrary, Beijing' has distanced itself from direct intervention in the IT sector via shifts in IT S&T policy and regulatory framework. The Chinese state's IT development model is quite distinct from that employed in former Leninist states, and the Chinese state's influence in S&T development is not exclusive. Like any successful organization, the state has had to revolutionize it's S&T development policies. And this has meant decentralizing decision and policy-making authority as well as liberating domestic firms from centrally planned controls. As a result, the bureaucratic policy-making framework, underpinned as it is by bargaining among interest groups, has evolved to allow for "fragmenting and disjointing" among the lower echelons of state authority. Further, although the power to create and regulate the context and regulations for

S&T development policy remains in the hands of Beijing's powerful party elite, NGEs and foreign actors (WTO, IAS), which in earlier eras Beijing muted, have seen their positions within the policy-making framework steadily increase. These actors will find their bargaining positions grow vis-à-vis their Chinese counterparts as China continues it's process of economic reforms.

This work also had the dual task of conjecturing as to how China's WTO-ascension will affect it's S&T development policy. China, it seems, is not content with becoming an IT powerhouse; it now aspires to IT superpower status. What we can expect in the future is for China, as a matter of course, between the choice of two options-- *techno-nationalism* and *techno-globalism*--China will continue to employ the hybrid policy line *neo techno-nationalism*. To reiterate, *neo techno-nationalism* consists of four definitive practices: 1) expanded state commitments in promoting domestic technological innovation; 2) a greater reliance on private actors and the co-mingling of public and private initiatives; 3) increased openness to foreign firms and influence; and 4) increased chances for cooperation and conflict among states. As the WAPI case illustrates**,** China's post-WTO ascension S&T development policies will be marked by a willingness to use standards regimes to curb encroaches by foreign IT firms and spawn domestic producers when Beijing deems it essential. Obviously, those given charge of China's territorial integrity and IT sector growth will decide what is essential. Without doubt however, issues dealing with military security and intelligence, state secrets and protecting the CCP's control of the flow of information will promote *techno-nationalism* in Chinese

S&T policy as will China's outstanding domestic political concerns, fears over becoming too technologically dependent on IT developed overseas and lingering frustrations over having to pay hefty royalty payments to foreign firms. Tempering these factors, however, are China's budding technological confidence in itself and the letter of the WTO regulations.

Moving now to the implications, one of the more interesting implications of this research and the primacy it puts on Chinese political economy is the insight it offers regarding the ongoing debate regarding chances for China's 'leapfrogging.' Leapfrogging refers to skipping development phases of industrialization and achieving the ranks of more developed economies via introduction of IT and new technologies.[127] Many scholars are decidedly pessimistic for China's chances to leapfrog from its current position. Their argument is based largely on the traditional neo-classical economic assumption that states will produce goods predominately in areas in which they enjoy comparative advantage relative to other economies. [128] With its abundant labor supply and relatively low wages, China is one of the world's largest manufacturers of low-value added products. And in theory at least, one would have a difficult time forecasting China's leapfrogging based on its current industrial production orders and levels as IT innovation is concentrated in countries with already high levels of technological infrastructure, high education levels and correspondingly high levels for

[127] Chi Hung, Kwan, "The Rise of China and Asia's Flying –Geese Pattern of Economic development: An Empirical Analysis Based on US Import Statistics," p. 10.

technological 'sophistication,' of which China is lacking comparative to Korea, Japan, the US and the more developed EU nations. Kwan, for one, takes comfort with this: "since the educational level of the country [China] as a whole cannot be improved significantly in short time, the economy can only develop by moving forward one step at a time."[129]

Still, as C. H. Kwan admits, China's share of the international IT sector has grown by leaps and bounds. By way of example, using US import statistics as a proxy measurement, the value of China's IT exports to the US was US$1. 5 billion in 1990; this figure had reached US$ 26.2 billion by 2000—a nearly twenty-fold increase. In terms of share of the IT exports to the US, the figures for China jumped from 9.9 percent in 1990 to 26.2 percent in 2000.[130]

On the whole, the argument that China is unable to vastly improve education levels in the whole country 'significantly in a short period of time' is reasonable. China is a huge country with 1.3 billion people. How necessary is it, however, that China significantly alters education to continue its current double digit IT sector growth? We must keep in mind that with this same workforce China's IT sector growth rates are more than double growth rates in other sectors. In addition, such an approach discounts the ability of the Chinese government to lure back overseas Chinese students working on graduate and post-graduate degrees in S&T and continue to attract IT spillovers from foreign MNCs via R&D ventures with Chinese partners. It also discounts the Chinese government's ability to 'artificially' induce growth in the IT sector via

---

[128] Ibid

[129] Ibid p. 11

state-led development initiatives. One of these initiatives, as we noted earlier, is constructing a standards based S&T development regime. In this respect, China is both a "fast follower" and a "standards setter." States employing the "fast follower" approach, like South Korea, devote their R&D resources to finding new uses or innovations that build upon existing international standards and technologies. "Standard setters,' by contrast, trusting their market size is vast enough and they have sufficient clout in the international political economy, attempt to work international standards in their favor, recasting them along domestically developed lines. China has the dual advantage of being able to oscillate between the approaches according to it's interests, luxuries smaller economies (in terms of population and geography) such as South Korea, Taiwan, Singapore, France, the UK and others are not afforded. For these reasons and a host of others we are *cautiously* optimistic about China's chances to leapfrog to higher industrial orders.

Lastly, the lessons gleaned from this work point to suggestions for further research. To begin, regarding S&T development in China, researchers need pay close attention to precisely how the state is working within markets to help domestic IT firms. The jumping off point for a comparative analysis of China's S&T policy-making, therefore, should begin with analysis into conflicts of interests within bureaucratic policy-making and implementing groups. After all, how China will use international and domestic markets to create and ripen market shares for national corporations and intra-national ventures will depend largely on the domestic political-economic agenda. Along these lines, later research regarding China's S&T development should also

---

[130] Chinese Statistical Yearbook, 2001.

weigh proportionately the role of local and central governments in S&T development. As we outlined in this work, the Chinese economy is a collection of separate regional entities each with distinctive patterns for supporting S&T development. Levels of NGE participation in regional IT sectors, for example, have depended largely on the positions of local governments. Where local governments are more supportive of NGEs, these NGE's have played an ever-increasing role in IT development, design, production etc . . . with the opposite holding for regions still dominated by medium to large SOEs. It may be asking too much to much to localize all or most discussion regarding China's S&T development and the enforcement of S&T policies; nonetheless, breaking our intellectual dependence on considering China's S&T development from the context of a national economy led by central development planners will assist greatly in helping paint a more coherent and accurate portrait of practices in the IT sector. Finally, using sophisticated econometric models to chart the course of China's IT development are helpful; but, as future predictors of China's IT industries, the calculus must be rewritten to account for the developmental role of the state not only by means of financing and R&D but also government procurement and technology standards regimes.

References

Books

Burstein, Daniel and Keijzer, Arne De, *Big Dragon! The Future of China: What It Means for Business, The Economy and the Global Order*. New York, NY: Touchstone, 1998.

Blomqvist, Hans, C. *Economic Interdependence and Development in East Asia.* Wesport, Connecticut: Greenwood Publishing Corporation, 1997.

Economy, Elizabeth and Michael Oksenberg (Ed.) *China Joins the World: Progress and Prospects.* New York, NY: Council on Foreign Relations, 1999.

Hu, Weixing, Chan, Gerald, and Zha Daojiong. *China's International Relations in the 21st Century: Dynamics of Paradigm Shifts.* Lanham, Maryland: University Press of America, 2000.

Lo, Chi. *When Asia Meets China in the New Millennium: China's Role in Shaping Asia's Post-Crisis Economic Transformation.* Pearson Publishers, Singapore, 2003.

Lieberthal, Kenneth and Lampton, David M. , eds. *Bureaucracy, Politics, and Decision Making in Post-Mao China.* Oxford, England: University of California Press, 1992.

Segal, Adam. *Digital Dragons: High-Technology Enterprises in China*. Ithaca and London, Cornell University Press, 2003.

Yusuf, Shahid. *Innovative East Asia: The Future of Growth*. Washington, DC: World Bank, 2003.

Articles/Essays:

Abeysinghe, Tilak and Lu, Ding, "China as an Economic Powerhouse: Implications on It's neighbors," China Economic Review, vol. 14, Spring 2003, pgs. 164–185.

Chang, Se-moon, "Export Patterns of Korea, China," Korea Times, August,

2004.

Christensen, Thomas J., Pride, Pressure and Politics: The Roots of China's Worldview," in Yong Deng and Fei-Ling Wang's *In the Eyes of the Dragon: China Views the World* (Lanham, Maryland: Rowman and Littlefield Publishers, 1999) pgs. 211-239.

Deng, Yong, "Conception of National Interests: *Realpolitik*, Liberal Dilemma, and the Possibility of Change," in Yong Deng and Fei-Ling Wang's *In the Eyes of the Dragon: China Views the World* (Lanham, Maryland: Rowman and Littlefield Publishers, 1999) pgs. 47-73.

Deng, Yong and Wang, Fei-Ling, " Toward and Understanding of China's World View," in Yong Deng and Fei-Ling Wang's *In the eyes of the Dragon: China Views the World* (Lanham, Maryland: Rowman and Littlefield Publishers, 1999) pgs. 1-26.

Economy, Elizabeth and Michael Oksenberg, "Introduction: China Joins the World" in Economy and Oksenberg's ed. *China Joins the World: Progress and Prospects.* (New York, NY: Council on Foreign Relations, 1999) pgs. 1-42.

Groombridge, Mark, "China's Ascension to the World Trade Organization: Costs and Benefits," in Ted Galen Carpenter and James A. Dorns, eds. *China's Future: Constructive Partner or Emerging Threat*, (Washington, DC: Cato Institute, 2000) pgs. 149-165.

Guo, Baogang, "Political Legitimacy and China's Transition," *Journal of Chinese Political Science*, vol. 8, nos. 1 & 2, Fall 2003.

Hamrin, Carol Lee, "The Party Leadership System," In Kenneth Lieberthal and David M. Lampton's , eds. *Bureaucracy, Politics, and Decision Making in Post-Mao China*, (Oxford: England, University of California Press, 1992) pgs. 95-125.

Higgott, Richard, "The International Political Economy of Regionalism: The Asia-Pacific and Europe Compared," in William D. Coleman and Geoffrey R. D. Underhill's *Regionalism and Global Economic Integration* (New York: Routledge, 1998) pgs. 42-68.

Hoo, Stephanie, "China Seeks To Develop IT Own High-Tech Standards," May 24, 2004, http://www.informationweek.com/story/show Article.jhtml?articleID=20900553.

Keller, William and Samuels, Richard, “Innovation and Crisis in Asia,” in William Keller and Richard Samuels, eds., *Crisis and Innovation: Asian Technology After the New Millennium,* New York: Cambridge University Press, 2003.

Kojima, Kiyoshi, “The ‘Flying Geese’ Model of Asian Economic Development: Origin, Theoretical Extensions, and Regional Policy Implications,” *Journal of Asian Economics*, Vol. 11 (2000), pgs. 375-401.

Kraemer, Kenneth and Dedrick, Jason, “Enter the Dragon: China’s Computer Industry,” *IEEE Computer*, vol. 35, no. 2 (2002), 28–36.

Kumar, Nagesh, “Technology Generation and Technology Transfers in the World Economy: Recent Trends and Implications for Developing Countries,” The United Nations University, Working Paper 9702.

Kwan, Chi Hung, “The Rise of China and Asia’s Flying –Geese Pattern of Economic development: An Empirical Analysis Based on US Import Statistics,” a publication of the Nomura Research Institute, Japan, 2002.

Lampton, David M., “A Plum for a Peach: Bargaining, Interest and Bureaucratic Politics in China,” in Kenneth Lieberthal and David M. Lampton’s , eds. *Bureaucracy, Politics, and Decision Making in Post-Mao China,* (Oxford: England, University of California Press, 1992) pgs. 33-59.

Lan, Zou, “The Influence of China’s Think Tank on Government’s Policy formation in financial and Environmental Arena as well as Management of Public Crisis,” a working paper of the International Security Program of the Center for Strategic and International Studies, Washington, DC, June 2004.

Lee, Jong-Heon. “South Korea fears High-Tech Leakage to China,” United Press International, August 25, 2004.

Li, David and Li, Ling, “Finishing China’s Economic Reform: Challenges and Pitfalls,” Ted Galen Carpenter and James A. Dorns, eds. *China’s Future: Constructive Partner or Emerging Threat,* (Washington, DC: Cato Institute, 2000) pgs. 317-341.

Lieberthal, Kenneth, “The Fragmented Authoritarianism Model and IT

Limitations," in Kenneth Lieberthal and David M. Lampton's , eds. *Bureaucracy, Politics, and Decision Making in Post-Mao China,* (Oxford: England, University of California Press 1992) pgs. 1-33.

Lin, Ying, "The Political Basis of China's Telecom Reform: A Bureaucratic Interest- Group Model," presented at a meeting of the Western Political Science Association, March 11-13, 2004.

Linden, Greg, "Optical Storage In China: A Study in Strategic Industrial Policy," a publication of the Information Storage Industry Center, Graduate School of International Relations and Pacific Studies, University of California, September, 2003.

Lingle, Christopher. "Korea's Economic Woes," The Korea Times, August 11, 2004.

Lovelock, Peter and Ure, John, "Telecommunications and Policy-Making in China: A Two-Tier Bargaining Model," Telecommunications Research Project, Centre for Asian Studies, University of Hong Kong, 1998.

Lovelock, Peter and Ure, John, "China's Telecoms: Law, Policy, Regulations and Characteristics," a paper presented at the Telecommunications InfoTechnology Forum, Hong Kong, October, 28 1996.

Ministry of Science and Technology, People's Republic of China, "Annual Report (2001) of the National High Technology Research and Development Program of China (863 Program) Information technology," available at www.863.org.

Ministry of Science and Technology, People's Republic of China**, "**Spark Programme Report," Beijing, China, 2001.

Ministry of Science and Technology, People's Republic of China, **"**Torch Programme Report," Beijing, China, 1999.

Moon, Ilhwan. "Korea's China Play," Business Week Online, March 29, 2004.

National Computerization Agency, Republic of Korea, "2004 National Informatization White Paper," Seoul, Korea, 2004.

Naughton, Barry, “Hierarchy and the Bargaining Economy: Government and enterprise in the Reform Process,” in Kenneth Lieberthal and David M. Lampton’s , eds. *Bureaucracy, Politics, and Decision Making in Post-Mao China*, (Oxford: England, University of California Press, 1992) pgs. 245-283.

Naughton, Barry and Segal, Adam, “Technology Development in the New Millennium: China in Search of a Workable Model,” in William Keller and Richard Samuels, eds., *Crisis and Innovation: Asian Technology After the New Millennium*, New York: Cambridge University Press, 2003.

Naughton, Barry, “The Information Technology Industry and Economic Interactions between China and Taiwan,” a paper presented to the conference on “New Information Technologies and the Reshaping of Power Relations: An Approach to Greater China’s Political Economy,” CERI, Paris, December 16-17, 2002.

Naughton, Barry, “China as an Emerging Regional and Technology Power: Implications for US Economic and Security Interests,” testimony before the US-China Economic and Security Review Commission, One-hundredth Congress, Second Session, Feb. 12-13, 2004.

Pearson, Margaret, “China’s Integration into the International Trade and Investment Regime,” in Elizabeth Economy and Michael Oksenberg’s eds. *China Joins the World: Progress and Prospects*, (New York, NY: Council on Foreign Relations, 1999) pgs. 161-206.

Rawski, Thomas G., “China’s Move to Market: How Far? What Next?,” in Ted Galen Carpenter and James A. Dorn’s, eds. *China’s Future: Constructive Partner or Emerging Threat*, (Washington, DC: Cato Institute, 2000) pgs. 317-341.

Sigurdson, Jon, “China Becoming a Technological Superpower: A Narrow Window of Opportunity,” Working Paper No 194 of the Stockholm School of Economics, June 2004.

Suttmeier, Richard P. and Xiangkui, Yao “ China’s Post-WTO Technology Policy: Standards, Software, and the Changing Nature of Techno-Nationalism,” a special report of the National Bureau of Asian Research, Seattle, No. 7, May, 2004.

Shirk, Susan L., “The Chinese Political System and the Political Strategy of Economic Reform,” in Kenneth Lieberthal and David M. Lampton’s , eds. *Bureaucracy, Politics, and Decision Making in Post-Mao China*, Oxford: England, University of California Press, 1992, pgs. 59-95.

Tipson, Frederick, “China and the Information Revolution,” in Elizabeth Economy and Michael Oksenberg’s eds. *China Joins the World: Progress and Prospects*, (New York, NY: Council on Foreign Relations, 1999) pgs. 231-255.

Uchida, Yuichiro and Cook, Paul, “The Transformation of Competitive Advantage in East Asia: An Analysis of Technological and Trade Specialization,” working paper no. 63 of the Centre on Regulation and Competition Institute for Development Policy and Management, University of Manchester, June 2004.

Wang, Ling and Szirmai, Adam, “Technological Inputs and Productivity Growth in China’s High-Tech Industries,” Working Paper no, 27 of the Eindhoven Centre for Innovation Studies, The Netherlands, March, 2003.

Walsh, Kathleen, “Foreign High-Tech R&D in China: Risks, Rewards and Implications for U.S.-China relations,” a publication of the Henry L. Stimson Center, Washington, DC, 2003.

Walter-Wyatt, Andrew, “Globalization, Corporate Identity and European Union Technology Policy,” in William D. Coleman and Geoffrey R. D. Underhill’s *Regionalism and Global Economic Integration* (New York: Routledge, 1998) pgs. 140-158.

Wei, Zhang, “The Direction of Economic Policies of the Fourth Generation Chinese Leaders,” a working paper of the International Security Program of the Center for Strategic and International Studies, Washington, DC, June 2004.

Wenli, Zhou, “International Political Economy from a Chinese Angle,” *Journal of Contemporary China*, vol. 10, Fall 2001, pgs. 45–54.

Yamada Atsushi, “Neo-Techno-Nationalism: How and Why It Grows,” *Columbia International Affairs Online*, March, 2000, <www.ciaonet.org/isa/yaa01>.

Yao, Yang, "The Rational Versus the Political Model in Collective Decision: The Case of Land Tenure in Chinese Villages," China Center for Economic Research, Beijing University No. E2002003, May 30, 2002.

Yu, Bin, "China and It's Asian Neighbors: Implications for Sino-US Relations," Yong Deng and Fei-Ling Wang's *In the eyes of the Dragon: China Views the World* (Lanham, Maryland: Rowman and Littlefield Publishers, 1999) pgs. 183-211.

Yushi, Mao, "Fifty Years of China's Economy with IT Background in Politics and Society," in Ted Galen Carpenter and James A. Dorns, eds. *China's Future: Constructive Partner or Emerging Threat,* (Washington, DC: Cato Institute, 2000) pgs. 9-29.

Zha, Daojiong, "Chinese Considerations of Economic Security" J*ournal of Chinese Political Science*, vol. 5, no. 1, Fall 1998 pgs. 69-89.

------*World Investment Report 2003. FDI Policies For Development National and International Perspectives (China).* A United Nations/World Bank Publication, 2003.