

The Emergence of Chinese Techno-Industrial Policy:

From Megaprojects to Strategic Emerging Industries, 2003-2011

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After 2003, China's policy toward technology development and innovation shifted dramatically. Technology development has long been a central objective of China's leaders, but the new policy orientation displayed a much greater willingness to directly shape specific industrial sectors through government intervention than had been the case just a few years earlier, at the turn of the century. The shift in policy has been carried out through two successive "waves" of policy. The first wave reached its "peak" in the adoption of "16 Megaprojects" in late 2005-2006, incorporated in the Medium and Long Term Program of Science and Technology (MLP) with a core emphasis on "indigenous innovation". The second wave reached a "peak" with the adoption of the program of Strategic Emerging Industries (SEI) in late 2010. While there are important differences between these policies, they also have important commonalities. Together, these two policies processes constituted a continuous movement in the direction of greater direct government involvement in, and steering of, important sectors of the economy.

In this paper, we examine the policy formulation and implementation processes through which the central government carried out this policy shift. Our primary objective is to describe this important policy change. In the process, we advance two core arguments about the Chinese policy process. First, we argue that China's political system gives a specific, increasingly routinized, structure to the policy-making process, so that understanding this structure can help us understand both the process and individual policy outcomes. In a following section we describe a four-phase framework that makes the time structure of the policy process explicit. Each of these phases has a characteristic form and, crucially, the management of each phase is delegated to a different set of actors who shape their phase in predictable ways, in accordance with their own interests.

Second, we argue that the policy process is carefully structured to facilitate top-down decision-making, and therefore to achieve the top leadership's particular objectives. All the main participants understand that the "rules of the game" are given by the top leaders. In this framework, top political leaders derive direct influence and power from two sources. First, they produce provisional ideas and slogans, which define the political agenda of the top leaders. Second, they serve as architects of the specific consultative process, in the sense that they set up specific procedures that give voice and weight to different participants. Both these things signal to participants what types of input will be welcomed; and what types of output are expected. The

specific way in which the system structures input into the policy process has an important impact on outcomes.

This chapter examines two specific policy outputs: the 16 Megaprojects in the Medium-Long Term Program of Science and Technology (MLP) and the Strategic Emerging Industries (SEI) program. We are particularly interested in accounting for the emergence of three key features of China's current innovation policies, features that are particularly characteristic of the Megaprojects and the SEIs. In our view, the sudden prominence of these features presents a puzzle that needs to be explained. Together, the current prominence of these three features might be termed the re-emergence of "techno-industrial policy." The three features are:

- A significant increase in the input of budgetary and other resources to directly support investment in high technology sectors, as well as technology upgrading in traditional sectors;
- "Direct" policies, that designate specific sectors, firms, and technologies to receive support, in the expectation that this will increase the relative economic importance of favored recipients;
- Multiple, overlapping policy instruments to provide additional support or protection to specific sectors or firms, in order to augment the impact of direct support. The actual choice of instruments constantly changes, as instruments are adapted flexibly to a relatively consistent goal. The instruments are not objectives in themselves, but are subordinate to the choice of sectors or firms.

China's technology and innovation policies have become much more strongly characterized by each of these three features over the last ten years. The policies have gathered force over the past few years, especially since the global financial crisis. This policy shift is by no means over. As of mid-2012, momentum was continuing to build for further movement in this direction.

Theoretical Framework

This chapter is in the mainstream of studies of Chinese policy-making. The terms of reference for most studies were set by Lieberthal and Oksenberg's 1988 study on energy policy, in which they coined the term "fragmented authoritarianism."¹ In their framework, the policies emerge from powerful bureaucracies; however, these bureaucracies must bargain with other bureaucracies in order to achieve their desired outcomes. Top leaders broker this bargaining process, which is central to the policy-making process in China. As a result, policy-making is protracted, disjointed, and incremental. Since the 1990s, studies of the policy process in China

¹ Lieberthal, Kenneth and Michel Oksenberg, *Policy Making in China: Leaders, Structures, and Processes*. Princeton: Princeton University Press, 1988. See especially pp. 22-28 for the discussion here.

have tended to build on the fragmented authoritarianism framework by showing that consultation has broadened substantially and that many non-governmental actors, including social elites such as prominent scientists, think tanks, and interest groups now exercise influence over policy-making. Social liberalization has provided spaces in which policy advocates and policy entrepreneurs can survive and operate, bringing new political forces outside the government and Party structures to bear on the policy process.² In Mertha's words, what he calls "fragmented authoritarianism 2.0" is "no less fragmented, but less authoritarian."³

In contrast to Mertha, we document a process that is far less fragmented than the traditional "fragmented authoritarian" framework. We do not disagree with the research findings documenting an expanded network of consultation and discussion: technology policy is like other policy arenas in which non-governmental elites have been incorporated into the policy-making process.⁴ However, we diverge from fragmented authoritarianism (both the original and 2.0 versions), in emphasizing that the Chinese bureaucracy has now developed a set of broadly understood "rules of the game" that shape the competition for resources by bureaucrats. Top leaders—such as Wen Jiabao—understand and structure the terms of this competition. We do not observe bureaucrats engaging in a zero-sum struggle (or negotiated trade-off) over policy direction, instead we observe a structured competition over incremental resources. In this sense, bureaucracies are *weaker* than in the traditional fragmented authoritarian framework, and political leaders are stronger.

The emphasis of this chapter is on the particular structures and institutions through which the diverse views of a range of elite actors are consulted and incorporated into policy-making. We argue that the Chinese political system imposes a distinct structure on the policy formulation process, and that this structure strongly influences the policy outcomes. In particular, we emphasize the way in which top leaders structure the consultation process and manipulate that structure to achieve outcomes they prefer. This analysis leads us to conclude that the fact that the system is authoritarian continues to matter; in fact, as we discuss later, in some respects, the authoritarian aspects of the system are stronger today than they were in the 1980s.

² The best study in English of this process is Mertha, Andrew C., *China's Water Warriors: Citizen Action and Policy Change*. Ithaca: Cornell University Press, 2008. Mertha's study has the additional advantage that its main issue area, large scale dam-building, partially overlaps with Lieberthal and Oksenberg's study, providing especially crisp contrasts. The broadening of the sphere of discussion and consultation is also a major theme of the Chinese literature. See Chen Ling, Zhao Jing, and Xue Lan, "Optimize or Compromise? A Consensus-Centered Conceptual Framework of the Policy-making Process in Transitional China [in Chinese]," *Guanli Shijie [Management World]*, Vol. 8 (2010), pp. 59-72, on health care reform; Wang Shaoguang, "Patterns of Agenda Setting in China's Public Policy [in Chinese]," *Zhongguo Shehui Kexue [Chinese Social Science]*, Vol. 5 (2006), pp. 86-99; Jun Ma and Muhua Lin, "Policymaking in China: A Review of Chinese Scholarship," *The China Review*, Vol. 12, No. 1 (Spring 2012), pp. 95-122.

³ Mertha, p. what? Mertha calls it FA 2.0.

⁴ In fact, one of us has contributed to this literature. See footnote three. Give a broader list of sectors; and/or cite some other studies in which technology policy is influenced by non-governmental actors, perhaps including Suttmeier et al this volume.

The starting point of our framework is the fact that there is a centralized decision-making process in China. Top leaders, and especially Communist Party Secretary Hu Jintao and Premier Wen Jiabao, must personally pass on a breathtakingly broad range of policy issues. Miller (2011) argues that the degree of functional delegation to different members of the Politburo Standing Committee has increased, and claims that the Standing Committee routinely ratifies the decisions of the leader in charge of functional systems.⁵ Even so, a leader like Wen Jiabao spans multiple issue areas and must at least sign off on an even wider range of policies. With this large span of control, there is an urgent need to reduce complexity to a manageable form. Leaders have limited rationality and attention spans. A system must be in place to boil down decisions to their key elements and allow top decision-makers to make broad decisions in principle, delegating their specification and implementation. Obviously, the expanding sphere of policy discussion and consultation makes this problem even more challenging, since there are even more voices to listen to and interests to reconcile.

This challenge leads to a specific staged policy process. In our view, this policy process has become increasingly institutionalized since the turn of the century, and particularly under Wen Jiabao. We argue that the system is now highly institutionalized, in both of the senses specified by Ostrom: it is assigned to specific formal organizations; and it is strongly characterized by specific “rules in use” that shape expectations and behavior.⁶ This increased institutionalization can be seen as an adaptation to the greater range of voices now heard in the policy process. Sometimes this adaptation represents a good faith effort to accommodate diverse inputs; at other times it is better seen as an effort to coopt or suppress independent voices. Thus, the institutions sometimes stimulate and sometimes limit discussion and debate.

At the center of this process is the need imposed on the system to develop a programmatic policy formulation. Primarily, this need comes from the need of top policy-makers to reduce complexity, by making decisions in principle that guide many actors. Such decisions are a highly characteristic feature of the Chinese policy process. In terms of policy formulation, they mean that the key moment in policy formulation is not the selection between alternative concrete policy measures, but rather the hammering out of a programmatic policy. The objective of this stage is *not* to select a practical alternative, but rather to provide overall policy guidance. To be sure, this need for principles to guide actors is embedded in the Chinese system for other reasons as well, related to the need for the Communist Party to continuously exercise leadership and re-affirm its legitimacy; as well as the desire by individual leaders to establish key slogans, strategic directions, and “reign titles” to establish their significance and legacy.

⁵ Miller, Alice (2010). “The 18th Central Committee Politburo: A Quixotic, Foolhardy, Rashly Speculative, But Nonetheless Ruthlessly Reasoned Projection,” *China Leadership Monitor*, No. 33 (Summer). Accessed at <http://media.hoover.org/sites/default/files/documents/CLM33AM.pdf>

⁶ Ostrom, Elinor, “Institutional Rational Choice: An Assessment of the Institutional Analysis and Development Framework,” in Paul Sabatier, ed., *Theories of the Policy Press*. Second Edition. Boulder: Westview, 2007. P. 21-64, esp. p. 23.

Some elements of this process reinforce the top-down control of the leadership. Leaders serve as architects of the consultation process; they can shape the types of inputs that are solicited, and to some extent the “weight” that each input is given in the process of consensus-building; and of course, at the moment when a programmatic policy is adopted, the leader has the largest single voice. At the end, the leaders are free to accept or reject any outcome from the policy process. Of course, they must leave substantial leeway to decentralized actors in the specification and implementation processes.

These structures shape the outcomes; they provide an explanation for the puzzle that we outline in the introduction. The exact way they shape the outcomes is two-fold: the structures themselves tend to lead to certain outcomes; and the way the structures are manipulated by top leaders to achieve political goals also shapes outcomes.

A Four Phase Framework

For practical purposes, we identify four phases in the policy process. Each phase is characterized by a different dynamic and, importantly, dominated by different actors. The phases correspond to a movement “up” to a “peak,” in the sense that the highest political leadership becomes involved, followed by a movement “down” of implementation.⁷ An immediate caveat: the “peak” in the policy process does not correspond to the peak intensity of policy implementation. On the contrary, policies commonly develop additional momentum as lower level organizations compete to carry out top level mandates, so the highest policy intensity typically lags the determination of policy at the peak level. Our framework implies eight phases (four each for two policy waves), but we will present events selectively, rather than marching through all eight phases.

The first phase we term “policy gestation”, a period in which decentralized actors, responding to the general agendas set by the top leadership, put forward ideas and opinions designed to influence policy-making. In this phase, diffuse activity is mainly directed “upward,” toward the political leadership and top tiers of the bureaucracy. Ideas and interests compete in a process of lobbying and an attempt to influence popular opinion. Most actors are motivated by the desire to shape central government policy outcomes. This phase does not necessarily lead quickly to a policy outcome, but rather moves into a new phase when top political leaders decide to craft a broad policy outline.

The second phase is “programmatic policy formulation”, which begins as top political leaders initiate a process to formulate a programmatic policy. Top leaders have extremely broad policy portfolios and the time they can devote to a specific policy arena is limited. Inevitably, they must structure a process of consultation and document drafting. Top leaders then shape the

⁷ We thus use “peak” in the same sense as Liu et al use “Grade A” (and sometimes Grades B and C) to describe the highest political level. See Liu, Feng-chao, Denis Fred Simon, Yu-tao Sun, and Cong Cao, “China’s Innovation Policies: Evolution, Institutional Structure, and Trajectory,” *Research Policy*. 2011, in press. Doi: 10.1016/j.respol.2011.05.005

ultimate policy bargain by brokering different opinions and interest groups. Leaders exercise political entrepreneurship as they “spin” broad policies into packages that appeal to important groups and strengthen their political position. The Chinese political system is distinctive in that it very commonly produces a programmatic policy document at the end of this second phase. The top leadership ordinarily drafts a broad (but vague) policy document that is disseminated through internal hierarchical Communist Party and government channels. This programmatic document may not be openly published, and is typically couched in generalities, with only broad goals and vague objectives mentioned.⁸ Nonetheless, it serves to structure subsequent activity by enforcing a (sometimes artificial) consensus on key players.

The adoption of the programmatic policy document initiates a third stage of the process, which we call “policy specification,” in which policy is “fleshed out” or given substance. In a sense, this is the final stage of policy formulation, since the vague principles incorporated in the programmatic document could hardly be considered a completed policy. But this stage also marks the beginning of the policy implementation process, and the beginning of a new kind of lobbying in which interest groups struggle to shape the interpretation of various policies in line with their interests, and directly influence jurisdiction and control of resources. Particularly striking in the Chinese environment is that the responsibility for policy specification is typically delegated to a bureaucratic organization that also has responsibility for later implementation, including control over budgets. As a result, there is often a great deal of politicking at the stage where responsibilities for policy specification are parceled out among competing bureaucracies, and different groups try to ensure that concrete provisions that serve their interests are inserted into the specified policy document. There are often delays at this stage. Of course, top leaders don’t just delegate policy specification and take a “hands off” attitude, they also oversee the process. Nevertheless, the locus of activity shifts down a level in this third stage, various groups end up with control of resources and a degree of practical discretion that may be completely aligned with the initial intentions of top leaders.

The fourth stage, policy implementation in the ordinary (narrow) sense, begins when the activities initiated by the policy begin to interact with the real world.⁹ Thus, implementation in this sense is characterized by imperfect success and unanticipated consequences. The realism of a policy begins to be judged as its provisions collide with the real world. Politicking and lobbying is an important part of this process. Although policy implementation in this sense is obviously an integral part of the policy process, we discuss it only briefly and in passing. This

⁸ It thus resembles the laws passed by Chinese legislative bodies, which typically enunciate general and vague principles that leave enormous room for discretion and interpretation. See Peter H. Corne, “Creation and Application of Law in the PRC,” *The American Journal of Comparative Law*, 50 (2002), pp. 369-395, esp. pp. 374-376; Perry Keller, “Sources of Order in Chinese Law,” *The American Journal of Comparative Law*, 42:4 (1994), pp. 711-759.

⁹ In contrast with the third stage, in which policy specification is completed when certain kinds of documents are produced.

paper is more concerned with the processes of policy formulation and specification, and we leave the questions of the effectiveness of policy and its unanticipated costs for future work.

The broader processes of policy formulation and policy implementation of course overlap in time in more complex ways, especially when there is feedback and policy revision, as often occurs. Moreover, it is of course possible to trace analogous policy formulation and implementation in any political system. But the processes of policy formulation and implementation have a *much* more definite structure in China than in most other political systems. This is because the Chinese system is authoritarian and hierarchical, and also because leaders devote a great deal of energy to formulating programmatic documents that contain key “national policies.” (国家政策) These policies function as consensus documents, a point in the policy process where the top political leadership declares and enforces the idea that the basic policies have been accepted and adopted and basically agreed upon. From this point, it becomes much more costly for individuals or interest groups to oppose—or even to criticize—the policy. This means that in the case of a major policy re-orientation, such as occurred with “indigenous innovation,” there is a very definite temporal structure to the policy process (see Appendix Box). This effort to create broad national policies marks many policy arenas in China, not just innovation policy (for example economics, foreign policy, culture and ideology). It is a defining characteristic of the political system.

Initial Conditions

The Suspension of Reform and Market-Oriented Technology Policies

Policies to promote rapid technology development enjoy extraordinarily broad support among Chinese elites. This has been true at least since Deng Xiaoping used support for science and technology (“as the most important production factor”科技是第一生产力) as part of his campaign to re-orient Chinese politics after the Cultural Revolution. The Jiang Zemin-Zhu Rongji administration in the 1990s also considered support for science and technology as one of their key objectives. Jiang Zemin launched the policy of “Reviving the Nation through Science and Education [科教兴国]” in 1995, and it was maintained through the turn of the century. Simplifying considerably, this policy could be understood as consisting of two primary thrusts: first, increasing investment in scientific research and education; and second, encouraging scientists and engineers to commercialize their products. Thus, while the government was to increase its investment in human capital, enterprises were supposed to take over the bulk of research and development, including the commercialization of R&D output. Many government research institutes were converted into enterprises in order to foster this commercialization. After 1999, an increased stress was placed on the need to convert research output into viable products and businesses, but this was consistent with the push to commercialization.

The Jiang-Zhu technology policies must be considered in the broader context of major economic reforms. The Jiang-Zhu policy came as part of—and in the wake of—the sustained

push for economic reform that lasted from late 1992 to late 1999. By the end of 1999, China had capped this remarkable transformative period by agreeing on a program for WTO entry that would kick in at the end of 2001. Technology policy was certainly part of this reform wave: Technology policy at this time was more market-oriented than any that had come before, and often gave priority to creating conditions for “silicon valley” type entrepreneurship in China. As a result, policy was quite favorable to private business, and many of the preferential policies toward state-owned enterprises were scaled back. In a related fashion, “planning” was at low ebb. Of course, industry bureaucrats continued to turn out plans, but plans increasingly were indicative documents concerned with tracking and responding to market demand. For example, the auto industry plan in 2001 emphasized the need to better understand and respond to domestic demand, and to produce very small cars that the market demanded. Moreover, the plan referred five times to the “need to participate in the global division of labor” (CNAIC, 2001; Anderson 2011). Such plans were clearly more concerned with adapting to the unknown impact of WTO membership, and were designed to help firms adapt, rather than dictate how firms would develop.

Government efforts to steer technological progress were very modest. The Tenth Five Year Plan was essentially a list of diverse policy objectives, with no particular structure or priority. Technology was certainly seen to be important, but was generally raised along with education as in need of investment to strengthen long-run capabilities. Zhu Rongji discussed the need to improve indigenous innovation capability (提高自主创新能力), but he applied this formulation to a limited number of high priority sectors with national security implications.¹⁰ The leadership grappled with the implication of the information revolution, setting up a high-level “Informatization Leadership Small Group” in 2001, headed by Zhu Rongji, with Hu Jintao as first vice-head (and Zeng Peiyan as office head). While stressing the importance of information technology, the group’s very first declarations were that informatization should follow market demand and should pay for itself (i.e., be profitable); that government should lead certain aspects of the development of information technology but that this should be combined with the transformation of governmental functions, including more transparent web-based governance.¹¹ The small group also advocated the application of information technology to traditional industry, and eventually approved a Planning Commission plan for the development of the IT industry during the 10th Plan, but not until two years into the plan, and without much conviction.¹²

¹⁰ Zhu Rongji, “Report on the Outline 10th Five Year Plan for Economic and Social Development,” March 5, 2001, National People’s Congress. In *历史的跨越*, pp. 1059-1072, citation on p. 1066; See also Zhu Rongji, “Explanation of the ‘Suggestions’ for Drawing up the 10th Five Year Plan for Economic and Social Development,” October 9, 2000, in *ibid.*, pp. 1045-1055.

¹¹ He Jinsong, “Zhu Rongji chairs the first meeting of the national informatization leadership small group,” Xinhua News, December 27, 2001, accessed at <http://news.sohu.com/85/01/news147530185.shtml>

¹² 我国信息化明确三大任务 Oct. 29, 2002 <http://www.sz.sx.cei.gov.cn/gzxxh/wgxx.HTM>; 信息化步入新阶段 Jan 2, 2003. Accessed at <http://www.sz.sx.cei.gov.cn/gzxxh/XXHBRXJD.HTM> .

At the turn of the century, only few “plan” was really designed to shape the direction of industrial development. 例如 2000 年的国务院 “18 号文件”, and that was the priority development program for the integrated circuit and software industries, which were given extensive tax and finance privileges [18 号文件]. This plan was conceived of as a way to guide the market: its main objective was to induce foreign firms and domestic private companies to invest in the semiconductor industry, which had previously been monopolized by state firms as a “strategic industry.” Tellingly, the inspiration for the particular policy provisions came more from Taiwan than from China’s own experience with the planned economy (Howell et al., 2003). Thus, at the turn of the century, technology policy seemed to be settling into a new, less interventionist and more market-oriented pattern.

The Critique

In fact, within the next few years, a dramatic shift in policy occurred. It is impossible to consider this shift without considering the broader change in policy orientation around 2003-2004. After a decade of dramatic change, “reform fatigue” had clearly set in by the early 2000s. State-owned enterprise (SOE) reforms had been accompanied by a dramatic surge in unemployment (ultimately temporary) and a collapse of many social services, traditionally provided by enterprises and collectives. Income inequality and corruption created dissatisfaction with the reform trajectory, and there was a broad debate in those years between those who urged further marketization and “completion” of the reform project, and those who argued scaling back and rethinking the marketization process.¹³ The impending membership in the WTO also meant that bureaucrats had their hands full in terms of adapting regulations and policies to be WTO compliant, while also worrying about the impact of WTO-driven market opening on Chinese firms. Under these conditions, an unmistakable slowdown in the pace of economic reform was not surprising; public opinion shifted; and policy-makers preferences also seemed to reflect this.

During this period, it was increasingly common to hear criticisms of the excessive reliance on marketization (and “enterprise-ization”) of China technology policy. In this view, the preceding phase of technology policy had actually weakened China’s technological capability, because many research institutes had been converted into enterprises, and many top scientists and engineers either went to foreign companies or became managers instead of scientists. Providing incentives for commercialization was a good idea, but if the state did not provide adequate resources for research, it was unlikely that the market would provide it in an economy at China’s level of development. Scientists and bureaucrats at MOST (Ministry of Science and Technology) were of course especially receptive to this argument, since it implied that they should receive more attention and more resources, as the primary conduit for China’s science outlays. One MOST analyst argued that China had tried to move prematurely to an

¹³ Li Liang, Xu Tonghui, Third wave of reform debate 2004–2006 中国第三次改革论争始末, *Nanfang Zhoumo*, March 16, 2006. Accessed at: <http://news.sina.com.cn/c/2006-03-16/10379365018.shtml>.

enterprise-based innovation system, and needed to step back into a more appropriate pattern of government support-led innovation.¹⁴

These concerns were intensified by increasing understanding of China's position in global production networks. During the 1990s, foreign direct investment had been by far the largest source of new technology for China, and China was integrated into trans-national systems of production. However, as this success was further analyzed and understood, it was increasingly recognized that although China was producing more and more sophisticated commodities for export, the actual production processes located within China were almost always low-skill assembly stages. Foreign companies concentrated their own activities on the high-tech stages of the production networks, while maintaining control over proprietary technologies, and maintaining their position as architects of the overall networks. This analysis was unquestionably correct, and it fed a sense of dissatisfaction with the achievements of the recent past.¹⁵ Moreover, awareness of China's passive and low-skill position in these networks naturally led to worries that China could be displaced by other low-income countries as Chinese incomes grew. The potential precariousness of China's technological position would later develop into concerns about a "middle income trap."

There were also legitimate fears that WTO membership would erode China's indigenous technological capacity. In this scenario, more advanced foreign firms would out-compete China's promising, but still not mature firms, and then acquire them. WTO membership might be good for China's economy in the short run, but bad for China's technological capacity in the long run. To some extent, "fear" of WTO was a simple expansion of the effort that bureaucrats were engaged in anyway, namely to craft policies that could be effective in the new WTO environment. For example, in agriculture, China studied the complex provisions on agricultural subsidies in WTO, and discovered it could easily increase farmer subsidies in categories in the "green box," which are permitted under WTO rules. These subsidies increased dramatically after 1999, and have reached 10% of agricultural output in some years, without pitching China into non-compliance with its WTO obligations.¹⁶ In similar fashion, China began to search for ways to carry out an activist policy and stay in compliance with WTO. How could China minimize the risk that immature local firms would be devastated by foreign competition in the more open post-WTO environment?

¹⁴ Hu Zhijian, "On Industrial Innovation Policy and Detailed Instruments" 企业创新政策与细则, MOST Powerpoint. Aug. 28, 2007.

¹⁵ Whether this analysis actually led to a reasonable policy prescription to de-emphasize China's participation in global production networks is of course an entirely different question. It is not at all clear that good cost-benefit analysis of the long-run impact of participation in such networks was being done. Of course, this is an extremely difficult analysis to do, and reasonable people will differ.

¹⁶ David Orden *et al.*, "WTO Disciplines on Agricultural Support," IFPRI Research Brief No. 16 (May 2011), accessed at <http://www.ifpri.org/sites/default/files/publications/rb16.pdf>

The First Wave: Mobilizing Indigenous Technology Resources for Engineering Megaprojects

The period of open, wide-ranging discussion about technology policy in the early 2000s was likely to produce many new policy initiatives, under any scenario. What is striking is the extraordinarily clear *direction* that policy ultimately took. Although the discussion environment was wide-ranging and included many different strands, the ultimate policy seized on only some of these strands, and headed off in a very clear and distinctive direction. In order to understand this direction, we need to follow the processes of policy gestation and formulation.

Policy Gestation motivated by Political Entrepreneurship

Hu Jintao and Wen Jiabao came to power in this environment, in which many political forces seemed to favor a pause, and perhaps a mid-course correction, in the 1990s policies of economic reform, despite their undeniable success. In fact, Hu and Wen moved quickly to put their distinctive mark on policy. Of course, this did not involve a repudiation of the Jiang-Zhu administration's policies, but rather a distinctive emphasis that could also claim to introduce a broader significance. In this way, Hu and Wen would be able to distinguish their administration from previous ones and stake their claim to a permanent political legacy. "Indigenous Innovation" and "Creating an Innovative Country" are part of this effort, and have been slogans almost from the beginning of the Hu Jintao-Wen Jiabao administration. Indeed, one semi-official source declares that "Since the 16th Party Congress (Oct. 2002), the idea of 'creating an innovative country' has been one of the major theoretical innovations and one of the major strategic directives of the Party Center with Hu Jintao as the General Secretary."¹⁷

Beyond the need to create a distinctive reign title, slogans and policies related to innovation are themselves creations of a leadership eager to consolidate and expand power. As top leaders preside over a process of upward percolation of viewpoints, suggestions and interest representations, they formulate these into new slogans and overall policy orientations (or "strategic policy," to use their vocabulary). Of course, to a certain extent this process of formulation is a simple matter of consolidating, summarizing, synthesizing, or balancing different viewpoints. But far more interesting is the process of political entrepreneurship, in which leaders creatively re-formulate and spin ideas to give them greater political impact and build or strengthen political coalitions.

A "Third Plenum" is the predictable place for a new administration to outline its political platform, since it takes place one year after the new leadership group assumes power, and after it has had time to fill out its staff, consolidate its initial grip on power, and flesh out its political program. Right on schedule, in October 2003, at the third Plenum of the 16th Party Congress, Hu Jintao began talking about "a scientific view of development," (alternately, "scientific

¹⁷ Cao Yingwang [Party Center Document Research Office], "十六大以来“建设创新型国家”述论," June 2, 2011, accessed at http://news.xinhuanet.com/theory/2011-01/20/c_121003854.htm

developmentalism”, 科学发展观). The scientific view of development is a broad, portmanteau type of concept. It accommodates a range of different objectives, including sustainability (in the environmental sense), greater investment in human capital (both health and education), and a more egalitarian, harmonious society. It is drafted in broad terms in order to attract a broad coalition of potential supporters. The scientific view of development certainly implies a stress on human capital and scientific and technological capabilities, but it does not *necessarily* include any commitment to “techno-industrial” policies. But, as we will see in the next section, already during this first year of the Hu-Wen administration, Wen Jiabao was taking steps that would tilt policies in this direction. More importantly, over the subsequent two years, there was a steady ratcheting up of the commitment to “indigenous innovation” and ultimately to techno-industrial policies. This shift of rhetorical emphasis reflects the political entrepreneurship of the Hu-Wen administration.

Hu Jintao assumed the top political position with a relatively weak political position. He was not part of his predecessor Jiang Zemin’s factional network, and had not been Jiang’s personal choice as successor. However, Jiang remained influential, and Jiang’s supporters occupied many positions of power and influence, including, by one count, six of the nine positions on the top political body, the CP Politburo Standing Committee.¹⁸ Moreover, Hu Jintao could not command a strong support base in either the military, or the “princelings,” those insiders descended from powerful Party elders. Hu Jintao and Wen Jiabao were, in a sense, alone together at the top of the pyramid. Such an initial power configuration meant that Hu Jintao had to proceed cautiously, gradually promote his own clients, and search for policy orientations that appealed to a wide spectrum of political groupings.

“Indigenous innovation” fit the bill. First, it appealed strongly to the military and to nationalistic sentiments in the population. To the extent that unease with liberalization and foreign influence had channeled into a surge of nationalist sentiment, “indigenous innovation” offered an appealing and practical medium-term objective. At the same time, the stress on innovation and productivity improvement also appealed to many economic reformers, who strongly supported the idea of reforming the growth model, investing more in human capital, and shifting toward a more knowledge-intensive growth path.¹⁹ Indigenous innovation improved the appeal of the Hu-Wen administration across a wide spectrum, without requiring an open break from the previous (Jiang) administration’s policy orientation.

Indigenous innovation as a slogan fit particularly well with the political image being crafted by the Premier, Wen Jiabao. From the very beginning of his term, Wen put policy emphasis on living standards and welfare institutions (民生), presumably reflecting some

¹⁸ Joseph Fewsmith, “The Sixteenth National Party Congress: The Succession That Didn't Happen,” *The China Quarterly*, No. 173 (March 2003), pp. 1-16, esp. p. 8.

¹⁹ For instance, the economist Wu Jinglian, one of the opinion leaders of the reformist camp. Wu Jinglian, *中国增长模式抉择* *The Choice of China Growth Mode*. Shanghai: Yuandong, 2005.

mixture of personal commitment, character, and political calculation. Wen was successful, particularly in rural policy, in reversing the deterioration in rural institutions and cutting taxes. Wen was rewarded with substantial popular support for these policies. However, China is not a democracy, and the winner of popularity contests does not necessarily wield real power. Wen Jiabao did not necessarily command the loyalties of the ministerial bureaucracies and local governments. Indigenous innovation provided Wen a way to build support among bureaucrats, companies and local governments, without abandoning his basic populist and welfarist orientation. Indigenous innovation itself is popular, and has particular resonance among younger, better-educated city dwellers, the large baby boom generation born in the 1980s and early 1990s. For Wen, it was a natural extension of his interest in education (he often mentions that his parents were teachers). For central government ministries and agencies, indigenous innovation offered a revitalized agenda, a renewed sense of purpose, and of course the promise of lucrative and interesting development projects, funded from central government coffers. That leads to the next section.

Programmatic Policy Formulation through Structured Consultation

The formal policy consultation process began immediately upon the assumption of responsibilities by Wen Jiabao (See Box 1 for Chronology of Key Events). On March 22, 2003, in the very first plenum of the new State Council, Wen Jiabao called for the drafting of a long-term science and technology plan.²⁰ Less than three months later, on June 13, 2003, while the SARS epidemic was still raging across China, Wen held another meeting and charged the participants with beginning the planning process. Crucially, Wen specifically instructed that the plan should “be implemented with **keypoint projects** and keypoint themes.”²¹ This is unusual in an initiating instruction for a long-range plan. Wen also laid out “Ten Instructions” to guide the formulation of the plan. **Moreover, while in the previous administration technology policy had been managed by the Vice-Premier in charge of industry (Li Lanqing), Wen now pulled technology into his own personal portfolio.**

Wen Jiabao now structured a wide-ranging consultation process to begin the drafting of the Medium and Long-Term Plan (MLP). First consulted was a group of elders, most of whom—Zhang Jingfu, Song Jian, Wang Daheng, Zhu Guangya, and Lu Yongxiang—had been engaged in the earlier stage of China’s science research system, beginning in the 1950s, that had focused on the high priority achievement of nuclear weapons and ballistic missiles. Indeed, the very idea

²⁰ It is true that outgoing Premier Zhu Rongji had presided over a meeting of the Science and Education Leadership Small Group on January 6, 2003 in which he heard a report from MOST Minister Xu Guanhua on a long-term plan, and Zhu directed MOST to continue consultations with other ministries on the issue. So the idea was clearly in the air. But Zhu’s directive was merely to allow a continuation of normal inter-ministerial discussions and politicking, whereas Wen’s directive clearly initiated a top-level process. Mei Yonghong and Pu Shurou, “温总理十条指导方针 酝酿中的中长期科技规划,” *Liaowang* March 27, 2004, accessed June 2011 at http://news.xinhuanet.com/newscenter/2004-03/27/content_1387533.htm

²¹ Mei Yonghong and Pu Shurou, “温总理十条指导方针 酝酿中的中长期科技规划,” *Liaowang* March 27, 2004, accessed June 2011 at http://news.xinhuanet.com/newscenter/2004-03/27/content_1387533.htm

of a 15-year plan explicitly evoked earlier long-run plans adopted in the 1950s and 1960s. China's "12-year Long-run Plan for Science and Technology [1956-1968]" was seen by these elders as having created the basic framework and structure of China's science and technology system, and to have played a long-run positive role. These elders could be counted on to prefer task-oriented planning, to "concentrate resources to accomplish great things (集中力量办大事)."

The second group consulted consisted of a large number of practicing scientists and engineers in the prime of their careers. In December and January (2003-4), almost 500 experts from across the country were gathered in Beijing for 40 days of intensive meeting.²² Overall, more than 1,000 experts were involved in writing, or consulting for, the initial plan draft.²³ Of course, it was understood that the scientists and engineers involved in these discussions would naturally want to shape the emerging plan draft to secure government support for their projects and institutions. Thus, the core components of the consultation process were structured to provide the kind of outcomes Wen had requested. Even beyond the inevitable effect of having a top leader lay out terms of reference that included "Megaprojects," the types of voices solicited would also support this approach.

A third channel of consultation was also opened up, with suggestions collected from forums and conferences, and through the mass media. In one important meeting in June 2003, prominent economists, including Lin Yifu, Hu Angang, and Jiang Xiaojuan, called for a re-affirmation of market principles and caution in extending direct government decision-making into technology choice. However, their views were rejected by the scientists present, and thereafter very few economists or management specialists were involved in the consultation process.

During this period, MOST was, of course, beginning the drafting of the Programmatic Policy Document itself, the MLP. Initially, proposals for mega-projects were solicited, and some 150-160 project proposals were submitted. Final selection was then made according to the extent to which the project would contribute to one (or more) of three goals: China's international image (like a moon shot); China's national security; or the upgrading of an industry sector.²⁴ By the end of 2004, the selection process was basically complete. It is noteworthy that during 2004, just as the megaprojects were being selected, public debate broke out among scientists about whether the plan gave too much power to bureaucrats. This public debate

²² Mei Yonghong and Pu Shurou, "温总理十条指导方针 酝酿中的中长期科技规划," *Liaowang* March 27, 2004, accessed June 2011 at http://news.xinhuanet.com/newscenter/2004-03/27/content_1387533.htm

²³ Shi Dinghuan (Vice Secretary-General of MOST, now a State Council adviser), "制定国家中长期科学和技术发展规划的新思路," *Jingji Ribao*, August 18, 2005, accessed at http://www.gmw.cn/content/2005-08/18/content_291552.htm

²⁴ Lin Hui, Ma Wei, Gui Xiaoshun, Meng Xianqiu, "A Guidemap to the Megaprojects" (重大专项藏宝图, *Keji Zhongguo*, April 27, 2009. Accessed at: <http://www.casted.org.cn/web/index.php?ChannelID=10&NewsID=3793>

has been well covered in the secondary literature.²⁵ In our view, however, most of the key decisions structuring the planning process had already been made by the time this debate erupted; it was when the final decisions were being made that some scientists realized the outcome would be tilted toward large show projects managed by bureaucrats. After the end of 2004, the policy process went rather quiet. In our view, this reflects an unusual amount of activity in lobbying over the specification of the plan. When the policy was finally issued in February 2006, policy specification occurred within the month. For most of 2005, attention of top policy makers turned to developing the 11th Five Year Plan, and the MLP, basically complete, was held until much of the specification was completed.

Policy Specification

There is no doubt that the 16 megaprojects were designed to be the “killer apps” of the MLP, and they attracted a great deal of attention from the beginning.

Policy Implementation

Government Agencies and Ministries:

Implementation of the large mega-projects required coordination across many different government departments. Three layers of management were established to coordinate the projects, and some experts argued that coordination costs were excessive.²⁶ Even though the MLP had included a relatively high degree of specificity, it was still more than two years after its promulgation when the first mega-project was formally approved. (This was the April 2008 launch of the core electronic components-CPU-basic software project). The three main bureaucracies in charge of the megaprojects are MOST, NDRC and the Ministry of Finance (MOF). MOST is responsible for coordinating the projects and linking them with the science and technology plans, as well working out the specification of measures for each project. NDRC is responsible for the complementary industrial policies and the coordination between megaprojects and national infrastructure projects. MOF establishes complementary budgetary and taxation policy, while also auditing and exercising financial oversight. The megaprojects office in MOST has only 5 employees, so they mainly spend their time sharing information and coordinating activity among different ministries.

Each megaproject has its own leadership small group, under the supervision of different ministries. For example, the Ministry of Health oversees implementation of the major drug initiative; the National Environmental Protection Bureau (NEPB) oversees implementation of the

²⁵ Simon and Suttmeier;

²⁶ Chen Lei, “Megaprojects are an accelerated icebreaker; a commission member watches tens of billions of RMB in expenditures,” 重大科技专项加快破冰 委员关注数百亿经费流向 *Keji Ribao*, March 3, 2010, accessed at http://www.cnr.cn/allnews/201003/t20100304_506098012.html

environmental initiative, and the broadband mobile communication project is overseen by the Ministry of Industry and Information Technology (MIIT), etc. But each of the leadership groups is composed of multiple ministries, exercising leadership and oversight. For example, in the water pollution control project, implementation responsibility is divided between the NEPB and the Ministry of Construction, while the leadership group is headed by Zhou Shengxian of the NEPB, the vice head is from the Ministry of Construction, and MOST, NDRC, MOF, the Ministries of Water Conservancy, Agriculture, and Education all have a seat, as does CAS and CES. The agency that oversees implementation is ultimately responsible for the selection of the enterprises and research institutes that undertake the actual work. For example, in the “core components, CPU and basic software” project, the MIIT oversees implementation (and thus picks the firms) while MOST chairs the leadership group.

Interest Groups and Enterprises:

Since the megaprojects are intended to commercialize technology (产业化), enterprises are encouraged to participate and play a leading role. In the meantime, since 2003, central state-run enterprises have experienced dramatic increases in profitability, as their management has improved and their monopoly privileges been consolidated. Newly powerful central SOEs have been able to claim a prominent role in the implementation of the megaprojects. For example, implementation of three of the megaprojects is overseen by SOEs. The civilian aircraft, nuclear power plant and oilfield development are managed by large central SOEs. Four megaprojects-- numerically controlled machine tools; core electronic components-CPU-basic software; IC manufacturing equipment; and mobile broadband—have 2/3rds or more of their component projects entrusted to enterprises.²⁷ These are usually—but not always—SOEs. In the case of IC manufacturing equipment, the project is run by the Beijing and Shanghai municipal governments.

Even this brief sketch makes it clear that the megaprojects provide an enormous scope for patronage. Many of the most important central government bureaucracies are involved in one megaproject or the other. Spreading the benefits widely over a number of interest groups reflects a classic pattern of log-rolling and politicized resource allocation. Under these circumstances, it is reasonable to expect that coordination costs are high; lobbying and politicking is intense; and it is difficult to apply objective cost-benefit criteria to project selection (and continuation). One example of intensive politicking was the struggle for jurisdiction over the nuclear power plant project. This project had originally been under the control of the National Defense Industry Commission, but when Huang Ju, the Politburo Standing Committee member with jurisdiction over the commission passed away, the NDRC was able to wrest control of the project from the National Defense Industry Commission.

²⁷ Xu Jing, head of the Megaprojects Office, cited in Chen Lei, “Megaprojects are an accelerated icebreaker; a commission member watches tens of billions of RMB in expenditures,” *Keji Ribao*, March 3, 2010, accessed at http://www.cnr.cn/allnews/201003/t20100304_506098012.html

Table 1: Central Government Expenditures on Science and Technology

	Total Central Expenditures	of which: Science & Technology	of which: Megaprojects	(Billion RMB; Percent) S&T Share of Expenditure	Megaprojects Share of S&T
1996	215.1	24.3		11.3%	
1997	253.3	27.4		10.8%	
1998	312.6	29.0		9.3%	
1999	415.2	35.6		8.6%	
2000	552.0	35.0		6.3%	
2001	576.8	44.4		7.7%	
2002	677.2	51.1		7.5%	
2003	742.0	61.0		8.2%	
2004	789.4	69.2		8.8%	
2005	877.6	80.8		9.2%	
2006	999.1	101.0		10.1%	
2007	1,144.2	104.3		9.1%	
2008	1,334.4	128.5	6.0	9.6%	4.7%
2009	1,525.6	164.9	32.8	10.8%	19.9%
2010	1,597.3	172.8	30.2	10.8%	17.5%
2011	1,705.0	194.4	43.5	11.4%	22.4%

2011 is Budget Figure. Source: Annual Budget Reports; Science and Technology Yearbooks

More generally, Table 1 shows that the megaprojects have become an important part of total government S&T spending, accounting for about one-fifth in recent years. More tellingly, we can see that between 2007 and the 2011 budget, the share of central government outlays going to science and technology has increased somewhat, from 9.1% to 11.4%. Budgeted S&T outlays for 2011 are 32 billion RMB higher than they would have been if the S&T share had remained constant. However, megaproject funding is 43.5 billion. All other S&T funding is thus 11.5 billion less than it would have been if it had just maintained its share of central government expenditures. This demonstrates the clear tilt away from general expenditures and toward specific benefits that can be allocated to individual clients.

The Second Wave: The Strategic Emerging Industries

A second wave on techno-industrial policy has taken place immediately after the global financial crisis. Like the MLP megaprojects wave, the strategic emerging industries program culminated in a top level document, and by July 2012 had moved through a policy specification phase. The SEI wave differed in that the response to the global financial crisis was quicker, and it is a more explicit techno-industrial policy, with specific goals and roadmaps of selected industries. Part of the conception of the SEIs from the beginning was that global developments had created a new technological challenge and opportunity. The purpose of the SEIs was to convert the technological progress being supported by the MLP, and especially the megaprojects, into commercial applications that would change industry outcomes. Because more of the policy-

making was at the sectoral level, a larger share of the policy-making process could be contained within the State Council bureaucratic hierarchy.

Policy Gestation

Just as the megaprojects were finally getting underway, in 2008, China was hit by the unprecedented shock of the Global Financial Crisis (GFC). The GFC caused a dramatic shift in the policy-making environment. Another “wave” of innovation policies was developed with unusual speed. This program ultimately developed into the strategic emerging industries program (SEI) during 2009. The overall agenda setting and policy formulation process for the “Strategic Emerging Industries” (SEI) have the same basic form as that for the MLP, but with crucial difference that the process was much more rapid, compressed into a crisis pace in the wake of the GFC. Because of this rapid pace, it was also more closely managed by the political leadership, and again, by Wen Jiabao in particular.

As is well known, China’s response to the GFC was large, prompt and decisive. A large fiscal stimulus was put in place in November 2008, and a massive flood of bank credit began after the beginning of 2009.²⁸ Following this initial fiscal and monetary response, a series of ten “Industrial Revitalization” industrial policy documents were rolled out between January 14 and February 25, 2009. These documents were very concrete: they named specific projects and, in some cases, specific firms and sums of money. The Auto Industrial Policy, for example, authorized 10 billion yuan in additional funding to develop “indigenous brands” and other types of technological upgrading in the auto industry. What is less widely appreciated is that this same decisive response led to a rapid and forceful movement into more intrusive techno-industrial policies. In early 2009, the State Council was extremely pro-active in bringing the type of activism incorporated into the MLP mega-projects into a broader industrial policy context. On February 25—not coincidentally at the same meeting that the last of the Ten Revitalization Programs was approved--the State Council discussed an additional document on the important role of science and technology in maintaining stable and rapid growth. This was then issued on March 20, 2009 as Guofa [2009] 9.²⁹ The actual document does not seem to be publicly available. However, from secondary local government documents, we can see that it called for a rapid acceleration of all kinds of high technology projects, both infrastructural and enterprise-based, and for the designation of 500 national “innovative type” enterprises for special support.³⁰

²⁸ Barry Naughton, *China Leadership Monitor*, Nos. 27-29, especially No. 28 (Spring 2009) “Understanding the Chinese Stimulus Package.” Access at <http://www.hoover.org/publications/china-leadership-monitor/>

²⁹ State Council “关于发挥科技支撑作用促进经济平稳较快发展的意见。” Tao Chun, “Bring into play the role of science and technology in maintaining stable and relatively rapid growth,” *Xuexi Shibao*, May 5, 2009, accessed at <http://tech.sinoth.com/Doc/web/2009/5/5/25032.htm>; Nie Qiao, “国务院常务会议研究部署发挥科技支撑作用促进经济平稳较快发展,” 中广网, February 25, 2009, accessed at <http://finance.ifeng.com/roll/20090225/402159.shtml>

³⁰ <http://www.chinanews.com/cj/kong/news/2008/07-28/1327218.shtml>

中国首批 91 家企业被命名为“创新型企业”(名单)

2008 年 07 月 28 日 20:38 来源: 中国新闻网 发表评论

Later in the year, MOST Minister Wan Gang said “Nurturing and developing strategic emerging industries was an important element of the concrete instructions given in this document.”³¹ Local governments responded promptly with lists of projects and firms to support. Nationally, the first batch of “innovative type” firms was approved by August, mostly central government SOEs or established dynamic private firms. By May, Li Keqiang (the Vice Premier) had used the term “strategic emerging industries” at a meeting called to increase budgetary support for new energy and new vehicles, while Wen Jiabao presided over a formal agenda-setting exercise for the SEIs in late September 2009.³² This was only seven months after the concept emerged, an unusually compressed process.

The acceleration of policy was possible in part because there is substantial overlap between the megaprojects and the SEIs. This is most evident in electronics, where core components/CPU/basic software; IC manufacturing equipment; and broadband mobile wireless are closely related to the sector’s evolution. However, almost all the megaprojects have some relation to a SEI. This is virtually inevitable, given that the megaprojects from the start were directed at technologies that could be commercialized, and given that the scope of SEI is extraordinarily broad. There is also a closer relationship than just overlap. As Xu Jing, the head of the megaprojects office declared, “The megaprojects are an important vector for accelerating the transformation of the development mode and catalyzing the newly emerging strategic industries.”³³ SEIs are much bigger, though. In their final form, the SEIs cover seven areas, but fully 35 specific industrial sectors. Virtually every sector that is targeted as an emerging industry in any country is included in China’s SEI program.

To be clear, there are also important conceptual differences between the megaprojects and SEI. The role of government is in principle different. Government funds the megaprojects, even though enterprises often execute the project. Government is not supposed to create the SEIs through direct funding, rather government is supposed to “make the market,” creating favorable conditions for enterprises to develop and grow. **However, this distinction is often blurred in practice. For one thing, after the GFC, the existing megaprojects were put on an accelerated schedule. Originally, the 16 Megaprojects were budgeted for a total of 600 billion yuan, to be spread relatively evenly across three five year plans, from 2006 through 2020.³⁴ After the GFC, the decision was made to more all the megaprojects into full implementation by**

³¹“Develop the Newly Emerging Strategic Industry; Seize the Commanding Heights of a New Round of Development,”*Keji Ribao*, November 2, 2009, accessed at ??

³² Zheng Meng, “How the Concept of ‘Strategic Emerging Industries’ was Introduced,” *Caijing*, September 13, 2010, accessed at <http://magazine.caijing.com.cn/2010-09-13/110519793.html>

³³ Of course, Xu Jing is not a disinterested observer. Chen Lei, “Megaprojects are an accelerated icebreaker; a commission member watches tens of billions of RMB in expenditures,” *Keji Ribao*, March 3, 2010, accessed at http://www.cnr.cn/allnews/201003/t20100304_506098012.html

³⁴Lin Hui, Ma Wei, Gui Xiaoyin Meng Xianqiu, “A Treasure Map for the Megaprojects,”*科技中国* 2009、4, accessed at <http://www.casted.org.cn/web/index.php?ChannelID=10&NewsID=3793>

the end of 2009.³⁵ Special meetings were held, such as the one in Beijing on March 26, 2009 for the large-scale semiconductor manufacturing equipment project, to step up the pace of implementation, specifically with reference to the stimulus measures and the decision to include technology promotion as part of the stimulus.³⁶ As the Table shows, actual disbursements for the megaprojects more than quintupled from 6 billion RMB in 2008 to 32.8 billion in 2009.

Thus, the actual policy bundle that emerged by 2010 was a mixture of accelerated megaprojects; ten revitalization industrial policies (due to last until the end of 2011); and the new SEIs. Clearly the boundaries among these policies were often blurred. Moreover, the sheer scope of the policies meant that scope for patronage and particularistic benefits was far greater than had been the case before. A huge range of enterprises, especially SOEs, in a wide swath of industrial and service sectors, could not qualify for government benefits. Too much! Reader led astray!

Programmatic Policy Formulation

When the SEI initiative was formally announced, in September 2009, it already had an unusual high degree of specificity. Premier Wen Jiabao called three discussion meetings in rapid succession. Unusually, Wen had already selected seven industries for potential inclusion in the SEIs, and had experts report on the status of each.³⁷ In this environment, programmatic policy formulation was mainly carried out by the ministries and commissions with jurisdiction over these industries. Consultation was part of this process: During March and April 2010, a broad program of local studies was carried out, with the group holding meetings in Wuhan, Shenyang, and Shenzhen. These meetings were with local officials and firms, including private firms. However, most private firms were fairly well established, and the majority of firms were state-owned. Scientists were also well represented, as were representative of quasi-official business associations.

Still, progress in formal programmatic policy formulation was delayed by a whole series of tussles about exactly what would and would not be included in SEIs, and who would have jurisdiction, that last through most of 2010. Would “oceanic industries” be included in the SEI? Would the SEI specify pure electric vehicles or a more inclusive category of “new energy vehicles”? This latter argument was especially interesting because many of the key players had personal stakes in the issue. Wan Gang, the MOST Minister, made his name in China directing

³⁵ Chen Lei, “Megaprojects are an accelerated icebreaker; a commission member watches tens of billions of RMB in expenditures,” *Keji Ribao*, March 3, 2010, accessed at http://www.cnr.cn/allnews/201003/t20100304_506098012.html

³⁶ MOST, April 15, 2009, “国家科技重大专项“极大规模集成电路制造装备及成套工艺”推进会在京召开,” accessed at http://www.most.gov.cn/tpxw/200904/t20090415_68614.htm

³⁷ Zheng Meng, “The beginning of strategic emerging industries,” *Caijing*, September 2010, accessed at <http://magazine.caijing.com.cn/2010-09-13/110519793.html>

the fuel cell vehicle project at Tongji University, funded by the national 863 program.³⁸ Wan, who earned a Ph.D. in Germany and then worked at Audi for a decade, was said to favor a pure electric vehicle for the SEI. However, many others, including new MIIT Minister Miao Wei—himself a car guy—worried (correctly) that battery and fuel technologies were not advancing rapidly enough to warrant placing all bets on a pure electric vehicle. The more cautious view won out in the designation of a “new energy vehicle” sector, and more recently triumphed with the recognition that for the next ten years, China’s strategies will have to also include modifications of traditional technologies that are more fuel efficient.³⁹ Whether it is rational to have competing bureaucrats advancing opposing gambles of billions of dollars of the people’s money is, of course, a different issue.

With ministries, enterprises and, increasingly, local governments involved in the policy formulation process, the natural tendency is for the intensity of policy to increase. Lower-level units compete for resources, and also compete to demonstrate their compliance and enthusiasm for the new policies. That tendency is certain in evidence right now in China. It may indeed be particularly intense because the country is just beginning the transition to a new administration. Understandably, attention focuses on the new top leaders, who may, once again, bring in their own policy agenda and approach to political entrepreneurship. But equally important is the fact that political leaders at *every* level, down to the county, will begin to be replaced this year and next.⁴⁰ Incentives to demonstrate policy compliance are thus at their maximum.

A moderation of policies coming from the top could check this tendency to some extent, but no such moderation is in sight. On May 31, 2011, the Politburo conducted a collective study session on the SEIs, listening to lectures by eminent S&T policy intellectuals Xue Lan and Feng Fei. Whatever lesson Xue and Feng hoped to impart to the Politburo, Hu Jintao took away a lesson of continued enthusiasm. Among his five points, the fifth was “vigorously strengthen the degree of policy support [for the SEI], and bring into play the superiority of socialism in concentrating resources to accomplish great things (集中力量办大事),”⁴¹ As for the upcoming power transition, Li Yuanchao, the head of the Party’s Organization Department (and thus the man in charge of implementing the process) specifically said that one of his biggest problems is that “the distribution of specialized knowledge is insufficiently rational [among current cadres], and we lack cadres who understand emerging industries, modern services, finance, law, urban

³⁸ “Abstract of speech by Wan Gang head of the electric vehicle research program under MOST’s 863 program,” April 26, 2006, accessed at <http://auto.sohu.com/20060426/n243003576.shtml>

³⁹ Miao Yu was once general manager of the Dongfeng (No. 2) Auto Company in Hubei. He has promoted an inclusive auto development policy, to be incorporated in an auto industry ten year plan, covering 2011-2020. See Liu Xia, “MIIT Minister Miao Yu: For the next ten years we’ll have to simultaneously develop new energy vehicles and energy saving vehicles,” *Keji Ribao*, March 13, 2011, accessed at http://www.stdaily.com/kjrb/content/2011-03/13/content_284549.htm

⁴⁰ Sun Rongfei, “The political study of leadership replacement in Chinese Communism[中共“换届”政治学], Phoenix Newsnet, June 6, 2011, accessed at http://21ccom.net/articles/zgyj/ggzhc/article_2011060536924.html

⁴¹ Xinhua News Agency, “Hu Jintao advocates: Promote the rapid and healthy development of strategic emerging industries,” May 31, 2011, accessed at http://www.gov.cn/ldhd/2011-05/31/content_1874294.htm

construction and social management.”⁴² It appears that the commitment to strategic emerging industries is not moderating, and instead appears to be accelerating.

The formal SEI programmatic document, “Decision to Accelerate the Cultivation of Strategic Emerging Industries” 《国务院关于加快培育战略性新兴产业的决定》, was passed by the State Council in October 2010, and work was passed on to the line ministries to specify specific policies.

Policy Specification

The policy specification stage for the SEIs primarily consisted in drawing up the “12th Five Year Plan Development Program for Strategic Emerging Industries,” which specified concrete development targets and technology pathways for individual industries. This development program was drawn up by an inter-ministerial coordination group set up by the NDRC and the MIIT, in conjunction with a writing group staffed by NDRC personnel and some experts. Beginning in October 2010, this work went through three phases.⁴³

First, the writing group collected comparative international materials and commission studies from the Chinese Academies of Engineering and Science. They submitted a 2 million character collection of reference materials, organized discussions groups, and then had the inter-ministerial coordination group discuss and approve a program outline. Second, beginning in January 2011, the writing group repeatedly met with writing groups from the NDRC, MOST, MIIT and MOF to draw up a “first draft”. Then after the Politburo collective study session of May 31, in which Xue Lan and Feng Fei spoke and Hu Jintao offered a summation, the writing group met repeatedly to revise and incorporate those suggestions, and drew up a “draft for comment.” Third, this “comment draft” was sent to all the relevant ministries, provinces, and sector industrial associations. Then the China International Engineering Consulting Corporation organized a discussion meeting in which eminent economists, scientists and entrepreneurs participated. After incorporating the ideas of these experts, the writing group finished a revised draft and sent it to the inter-ministerial working groups, which approved it, and sent it up to the State Council as the “approval draft.” In May 2012, the State Council approved the program and formally promulgated it on July 9, 2012.

Policy Implementation

⁴² Sun Rongfei, “The political study of leadership replacement in Chinese Communism[中共“换届”政治学], Phoenix Newsnet, June 6, 2011, accessed at http://21ccom.net/articles/zgyj/ggzhc/article_2011060536924.html

⁴³ This account is all from one source, but what is the source?

Discussion

The return of techno-industrial policies in the 21st century is the combined outcome of a series of historical legacies and contemporary challenges. During the planned economy period, Chinese policy-makers habitually implemented various kinds of techno-industrial policies that covered virtually every industrial sector. In fact, you can find precedents for many of today's newly favorite megaprojects and SEIs in the planned economy period. For example, the “708 Project” produced the Yun-10, a 142-seat passenger jet that successfully flew in 1980; the “728 project” produced a 300 megawatt pressurized reactor that was put into commercialized operation at Qinshan in the 1980s and exported to Pakistan; and in integrated circuits the VLSI project approached global advanced levels at that time. (BN-this is just not true). However, these technological efforts were abandoned after the 1980s, as not a single one of them was able to enter into large-scale commercial operation in a China open to the international marketplace. Technology policy of this type was gradually replaced by the economic strategy of “trading market access for technology.” This marketized industrial policy was continued until 2003, when the newly installed Hu/Wen administration changed direction. Their aspirations for economic transformation and sectoral upgrading; their fears of the “middle income trap,” their belief in the efficacy of government expenditures and government intervention; created a powerful motivation for policy-making. However, the difference with the 1970s is that in the 21st century, China is in a globalized world, and has already created a basically market economy system, in a context in which the dispersed interests of the business world, and especially of the private sector are the dominant force in innovation, can industrial policy still be effective?

We have some basis for answering this question. The new techno-industrial policies may lead to some outcomes that are outside the original intention of policy-makers, but are nonetheless quite predictable. For example, the monopolistic position of embedded interest groups may be strengthened, harming market competition, and thereby diminishing the long-term market potential of future innovation. Before 2003, most technology funding went for items that were, with only a few exceptions, public goods. After 2003, as we have shown, the proportion of funding for goods with significant commercial benefits increased substantially. In each of the big megaprojects, many large SOEs, or a handful of well-established private firms, are involved. These policies are not very well targeted to the small, unstable emerging high-tech firms that can potentially play an enormous role.

Moreover, whether or not techno-industrial policies can succeed is determined by whether or not those who undertake the projects are able to leap the chasm that separates research and development from commercialization. In 1970s techno-industrial policy, this “breathtaking leap” was never successfully made. That is to say, the complex, high technology products that were indigenously designed were basically prototypes, which never completed the stages of product testing, industrial certification or market acceptance. (trans?没有走完产品试验、工业论证和市场适应的阶段)。Looking back on the failure of that round of techno-

industrial policy, the two final stages—industrial certification and market acceptance—were the really fatal shortcomings. For example, the Yun-10 aircraft developed in the 1970s and 1980s had unstable technical parameters, which were inappropriate for mass production; the fuselage shape was outdated, and it wasn't competitive in the marketplace; these were the true reasons it was abandoned. In order for the current round of techno-industrial policy to succeed, those undertaking the projects must carry out intensive integrated innovation, and learn commercialization by doing. Only in this way can they acquire the system integration capabilities; the production sector organization ability; the ability to respond to market needs; and the rich tacit knowledge related to these capabilities that are required for commercialization.

The techno-industrial policy was created through a top-down bureaucratic hierarchy and well organized consultation process. However, the “structured consensus” reveals several implications.

First, China's national policy is highly influenced by the succession process, even though new leaders come from the same political party. There is a tendency among outside observers to think that China's spectacular economic success shows that there is some basic pragmatic and flexible attitude (the “secret sauce”) that is shared among most members of the Communist Party elites. This is very unlikely to be true. The political coalitions and political entrepreneurship opportunities of different leadership groups are likely to differ substantially. It is obviously plausible that what Hu Jintao needed to achieve with political entrepreneurship was different from what Jiang Zemin had needed to achieve. The beginnings of the shift in innovation policy come almost immediately after Hu-Wen take over, even though the slow-to-change nature of programmatic policy only gradually reflects the change. Ultimately, this is top-down politics, and rapid change in policy follows promptly after change in the top leadership. Furthermore, we see repeated actions by top leaders, and especially by Wen Jiabao, to shape the entire consultation process so that certain viewpoints would be prominently represented and other viewpoints neglected, in a way that could predictably be expected to have the kind of outcomes we actually observe. Superficially the consultation process has been made more open than ever, with mechanisms ranging from internet suggestion boxes, to expert advisory commissions, to invitations to outsiders to make proposals. But in the end, the policy advice that comes from insiders is more trusted, as well as being more predictable. Unpredictable changes are likely after 2013, as new leaders take over at the top--and new leaders promoted from the bottom—throughout the Chinese political hierarchy.

Why did Hu Jintao and Wen Jiabao drive Chinese innovation policy in the way that they did? We cannot see inside their minds. We can suggest several plausible hypotheses, but we cannot test them against each other. These are: (a) they believed in it, seeking to make China a stronger and more technologically advanced nation; (b) they expected that the general policy would attract support from a broad range of influential groups, and from the public, and would contribute to a successful administrative term; (c) the GFC made them do it. It is highly significant that the period of policy changes is also the period in which the Chinese budget

emerged from the extreme stringency of the 1990s and began to reach something like abundance. From its low point in 1995, the *increase* in the budget's share of GDP was just over 10% of GDP (from 10.3% in 1995 to 20.9% in 2010).

In the short run, we should add, China's leaders have done this because they could. There is no imminent failure staring Chinese leaders in the face (unlike the situation in the 1990s). The money is there; the economy is successful; and they have achieved enough of their objectives that they can claim success. However, in the long run, the change in course in innovation policy will create as many problems as it solves. By undermining the foundation for a broad-based competitive innovation economy, and by tying so many of China's top scientists and engineers to a patronage network, the leaders may inadvertently have slowed down China's evolution into a technology sophisticated innovative country. The SEI initiative is enormously ambitious: much of its ultimate impact will depend on how flexibly and skillfully leaders respond to the differential successes and failures of its many different components.

Secondly, specific techno-industrial policies are also likely to be shaped by bureaucrats and those cooperative scientists/experts who seek government resources to pursue their scientific and developmental agendas. The pattern of structured consultation during policy formulation, and competitive politicking during policy specification, is unlikely to change dramatically. Our examination of the policy process shows government agencies pursue the power and resource from new policies, especially without a clear definition of division of labor. This tendency also enhances the trend toward increased planning, and a stronger, more intrusive, government role.

This partially explains a "decoupling" of policy and implementation. It is true that at the policy level, a commitment to free market competition and fair competition for government innovation resources has remained intact. However, our detailed analysis of policy stages can help understand this decoupling. In the first place, policy implementation is decoupled from programmatic policy because programmatic policies are consensual, and therefore slow-to-change, while implementation incorporates rapid response to the most recent events. In the second place, implementation falls under the authority of apex organizations that themselves have a strong interest in the way that policy is implemented. This is distinctively true in China because of the role the apex organizations play *both* in fleshing out policy, and in implementation *per se*. Thus, implementation constantly revises the original programmatic policy. Moreover, this happens in a predictable fashion, as implementation is deflected towards the specific interests of the implementing agencies.

Yet, in the end, we didn't see the influence of interest groups which might explain the dramatic shift in policy after 2003. In the first place, there is no sudden shift in the power of interest groups that can explain the dramatic shift in policy post-2003. It is true that the state enterprise sector becomes much more profitable, and more concentrated in a few large firms. Therefore, there is reason to suspect a partial reform equilibrium, in which reforms stall out

because of the ability of entrenched interest groups to prevent further reforms. But having richer SOEs is ambiguous. SOEs overall have greater political and lobbying clout (an “income effect”), but that also means that policy-makers *could* provide them fewer direct budgetary resources (a “substitution effect”). Policy-makers could decide that its time for SOEs to stand on their own two feet, and direct incremental budget resources to desperately needed social welfare. It’s impossible to predict which of these effects ought to be larger. More tellingly, we do not observe that channels for SOEs to exert influence on the policy formulation process are stronger than they were previously, and any increased influence on policy implementation is modest at best. There has been no large-scale change in the overt ability of SOEs to influence policy.

Conclusion

The close examination of the emerging techno-industrial policy in this chapter reveals a new model of China’s policy process, which we called “structured consensus model”. Under the structured consensus approach, policy process in China has become more regularized, more institutionalized, and more structured. (Moreover, as the FA 2.0 literature point out, this is also in many respects a more open system.) However, the outcomes of this gradual process of institutionalization are very different from what one might expect. Ordinarily, we would expect a more open and institutionalized process to contribute to a more diverse range of opinions being consulted, and to a more diverse and flexible range of policies. In turn, we might expect policy heterogeneity to contribute to the development of a market economy and an open society. But instead we see the overwhelming influence of top-down policy definition, and policy outcomes that are increasing in the form of interventionist techno-industrial policy. Ultimately, this is because the views of everybody are screened, interpreted, and synthesized by a select group of policy insiders. This process, as we have documented, is highly structured.

What will be the final outcome of these new technological policies? China’s innovation policy since 2003 represents a return to “techno-industrial policy.” The central government plays a decisive role in selecting technologies, determining technological strategies and monetary inputs. It cannot be said that this is a return to the era of the planned economy. China’s economy has already become a fundamentally market-based economy over the course of thirty years of transition. However, these policies have re-introduced many types of government intervention and many instruments reminiscent of the planning era. In the context of an incomplete market system, these policies have complex and uncertain impacts on market competition, the evolution of individual sectors and the process of technology upgrading. Some of the influence is positive. By stimulating and establishing markets for newly emerging technologies and products that embody those technologies; and by stimulating technical progress and sectoral upgrading; these policies may contribute to economic development and social progress. Some of the influence is negative, for example in entrenching existing interest groups, strengthening monopolies, and by undermining the vitality of technological innovation and market competition.

Four Stages of the Policy Process

Name	Activities	Actors	Outcome of Period MLP & Megaprojects	Outcome of Period Strategic Emerging Industries
Policy Gestation (Structured Gestation)	Competing interpretations of initial conditions Articulation of national security objectives Articulation of Interests	Think Tanks Public Intellectuals Bureaucracies Firms	March 2003 New leaders set agenda for MLP	November 2009: Wen Jiabao unambiguously signals SEI initiative
Programmatic Policy Formulation	Structuring Policy Advice Input Aggregating and Negotiating Viewpoints Political Entrepreneurship	Think Tanks Top Leaders	Feb. 2006 Medium and Long-term Plan for Science and Technology Development	Oct. 2010 Strategic Emerging Industries Decision
Specification of Policy	Completing Policy Formulation Beginning Policy Implementation	Political Leadership Apex Organizations	Dec. 2007 - May 2010 Approval of Individual Megaproject Programs by State Council	First Half 2012 12th Five Year Plan for Strategic Emerging Industries; Individual Sector Plans
Implementation	Achieve policy objectives Capture resources and expand span of control	Apex Organizations Bureaucracies Firms		

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