

# China's Hybrid Adaptive Bureaucracy: The Case of the 863 Program for Science and Technology

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*Portrayals of China's bureaucratic behavior tend to emphasize either streamlined central control via top-down directives emanating from a Leninist system, or a highly fragmented organization characterized by continuous horizontal bargaining. While both views have merit, they miss important but little-recognized dynamics of Chinese bureaucratic behavior. Examination of the 30-year evolution of a single organization, China's 863 Program, allows us a unique look inside the "black box" of decision making. First, we highlight a largely unrecognized mechanism of top-down control: a signal-response process that fosters substantial uncertainty for officials in the system. Second, our case highlights a circumstance in which reformers made radical moves—deployed as a "band-aid" layer of rational-instrumentalism—to meet a perceived external security threat. These moves demonstrate efforts to incorporate Weberian norms, and suggest sources of dynamism and learning in a "hybrid adaptive" bureaucracy.*

## Introduction

Policy formulated by China's enormous party-state bureaucracy has been crucially important to the regime's performance. Yet compared to the massive literature on state—society relations in China,<sup>1</sup> scholarship on the "black box" of China's bureaucratic behavior per se has been relatively (although not completely) dormant in recent years. This study seeks to renew focus on the complex dynamics that play out inside the recesses of the central bureaucracy as cadres formulate policy. We consider a modern version of the governance dilemma raised about imperial Chinese bureaucratic rule by historian Philip Kuhn (1987): How can we understand the simultaneous presence of both complex intrabureaucratic procedures and politically driven (and often arbitrary) intervention by leaders? As in imperial China, the current system houses both top-down pressures from political leaders and, beneath it, a fragmented horizontal bargaining game. At the same time, China's political leaders have in some instances sought to incorporate Weberian rational-instrumental principles in an effort to "modernize" the political system. While these seemingly contradictory threads are not wholly unique to China, we emphasize an aspect of China's political system that has not been extensively studied:<sup>2</sup> a signal-response mechanism in which vague signals (often political slogans) are sent by the center, and to which subordinate officials must demonstrate responsiveness well before detailed instructions are issued. This mechanism creates an uncertainty that hangs over the bureaucratic environment, yet also provides some flexibility (and negotiating space) as to how subordinate officials may respond. While this deeply embedded signal-response mechanism, and the ensuing uncertainty, contravene the goal of creating a more rational-instrumental

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system, it simultaneously helps the system to adapt to radically changing circumstances that China faces both domestically and internationally.<sup>3</sup>

We demonstrate these elements of China's bureaucratic behavior as they have unfolded over the 30-year evolution of a single bureaucratic organization, China's "863" program for funding science and technology. In a radical departure from dominant bureaucratic norms, Deng Xiaoping agreed in 1986 to establish a program that uniquely incorporated rational-instrumental tools, emphasizing merit-based decision making and the leading role of expert scientists over political cadres. Over time, these tools deteriorated substantially and were supplanted by the reemergence of many behaviors typically found in China's other bureaucracies, notably, efforts by political leaders to control implementing officials through vague signaling, as well as extensive intrabureaucratic bargaining. Our analysis of the 863 program's evolution shows why sustaining Weberian tools has been very difficult in post-Mao China. Yet the conclusion is not that these tools fail to have lasting impact. Instead, instruments that leaders initially applied as a "band-aid" have left a longer term imprint on post-Mao bureaucratic norms. In a process that roughly echoes the concept of "layering" found in historical institutionalism (Mahoney and Thelen 2010), learning has occurred such that merit-based principles have become embedded to a significant degree within the norms of the system. The ensuing behavioral amalgam leads us to characterize China's bureaucracy as "hybrid adaptive." Despite substantial weaknesses in terms of efficiency and accountability, the hybrid system we describe has allowed China's government to adapt relatively well to challenges in a time of rapid transition, especially where goals must be quickly met. The following analysis therefore offers a partial antidote to more simplistic and static pictures of Chinese bureaucratic processes that point simply to the party's impulse for control, opportunities for rent-seeking, or constant bargaining as the main forces shaping officials' behavior.

### Bureaucratic Governance in China

Scholarship on China's bureaucratic behavior tends to coalesce into two broad camps. Studies by Western scholars have been dominated for nearly 30 years by the concept of "fragmented authoritarianism." (Lieberthal and Oksenberg 1988; Mertha 2008). This theory depicts authority below the very peak of the Chinese political system as highly disjointed. It explains policy formulation and implementation as resulting from extensive horizontal bargaining by bureaucratic actors, a phenomenon that increased with the policy and resource decentralization of the early post-Mao era. Fragmented authoritarianism originated as an effort to debunk a second camp that focused on totalistic, top-down control by the party-state bureaucracy. Franz Schurmann's (1968) classic work on "ideology and organization" in particular emphasized the importance of the Leninist party-state hierarchy during the early Mao era. In recent years, discussion of top-down features has been revived. James McGregor (2010) highlights organizational penetration by the party structure. An extensive literature by scholars both inside and outside of China depicts the party's effort to control officials' behavior through a *nomenklatura*-based personnel management system that determines cadres' promotions through the ranks of the bureaucracy (e.g., Landry 2008; Li and Zhou 2005). Bo Rothstein (2015) argues that the party center's success at fostering cadres' ideological loyalty and passion for policy doctrine has allowed it to maintain control over subordinate cadres. Some scholars who emphasize the party's hierarchical control over the cadre corps attribute problematic outcomes to the top-down system. Xuegang Zhou (2013), for example, argues that the hierarchical bureaucratic tradition fosters cadre commitment on the basis of charismatic authority rather

than legal authority.<sup>4</sup> The cadre promotion system is seen to foster a variety of ills, including irrational overinvestment, collusion among local officials, and defiance of the center (Ahlers 2014; Burns and Zhou 2010; Mei and Pearson 2014; Zhou 2008). In tandem, some scholars assert that despite having constructed highly detailed formal organizational structures, the party lacks the capacity for Weberian rational organization (Fukuyama 2013; Rothstein 2015).

Each of these scholarly traditions has merit; fragmentation of and bargaining between bureaucratic units remains highly salient, at the same time as the party's elite leadership seeks to find ways to maintain control over its agents. Nevertheless, examination of the 863 science and technology bureaucracy over three decades suggests three correctives. First, with regard to the top-down tradition, scholars emphasizing loyalty, and the absence of Weberian tools, as driving cadre compliance underestimate the impact of reforms designed to promote "modern" governance using rational-instrumental measures. Second, to the extent that rational-instrumental tools remain lacking in the top-down control toolkit, it is not ideology-based loyalty to which cadres hew. A more "under the hood" perspective highlights a signal-response mechanism in which top leaders send out signals—often in the form of slogans—depicting the "spirit" of a policy. Subordinate cadres must then try to decipher, with very little information, how to implement these signals.<sup>5</sup> Third, the dominant camps often depict China's bureaucratic system as relatively static, and underestimate the degree to which the bureaucratic system has adapted in light of China's rapid integration into the international system.<sup>6</sup> Rather, challenges such as the need to upgrade China's technology have led the government to adopt rational-instrumental tools as short-term "band-aids," layered onto the existing system. These tools have over time become significant features of governance. The remainder of this section expands on these correctives to the dominant literature.

In contrast to suggestions that China's bureaucracy wholly lacks rational-instrumentalism, aspirations to employ Weberian tools to foster scientific and law-based policy have long had a place in post-1949 China, despite at crucial times being submerged. Weber's ideal-typical bureaucrats were to organize themselves according to rational-instrumental processes. Although these goals can never be perfectly achieved in practice, and many have identified their shortcomings, their influence in China cannot be denied. Harry Harding's (1981) survey of Chinese bureaucratic practice in the Maoist era discusses extensively the forces favoring use of rationalist bureaucratic practices alongside other approaches to bureaucratic management, notably cadre rectification. The push by President Xi Jinping's government to construct a "modern governance system" in certain ways furthers this impulse, as Xi stresses the need to adapt to the "modernization process of nations, enhance the Communist Party's capability for scientific governance, democratic governance, and the rule of law, and to continuously improve efficient governance capability ..." (Xi 2014, 104).

Of course, the party has also appreciated an oft-overlooked aspect of Weber's thought: the need for bureaucracies to be responsive to goals set by politicians. As Xi's statement also suggests, "scientific governance" operates in tension with the desire by party leaders to maintain top-down control with the capacity for disruptive intervention. Indeed, ideology remains a motivator, but not through the loyalty mechanisms suggested by Rothstein (2015). Chinese scholars in recent years have usefully pointed to several distinctive characteristics of the Chinese political system (e.g., Jin and Liu 2011; Qu 2012; Zhou 2008, 2013). These scholars suggest that the party uses the bureaucratic system to reinforce overarching core values akin to Kuhn's (1987) identification of the "ultimate goals" of the imperial system: "maintenance of the

existing social system, the fiscal and juridical soundness of the policy, and above all the welfare of the imperial court" (p. 84). Two core values remain most salient in contemporary China: "grand unity" (*dayitong*) and stability (*wending*) (Hua 1993; Jin and Liu 1992; Qian 1982; Wang 1948). Granted, these concepts easily appear hackneyed, yet they have been consistent reference points for the post-Mao regime in justifying broad policy directions. Stability refers to the desire to minimize social or political upset that would endanger the communist party-led political system. As Deng Xiaoping stated when meeting U.S. President George H. W. Bush in February 1989, "stability overrides everything." Stability does not equal stasis, however; Deng argued that in a volatile global environment and period of rapid transition, it is important to make adaptive changes to preserve stability. Unity refers the desire to preserve the nation as one whole, without undue forces to split it either geographically or politically. The goal of unity further seeks the preservation of one consistent ruling body.<sup>7</sup>

While the articulation of core values by the party leadership is unsurprising, we wish to focus attention on several less recognized operational mechanisms of the post-Mao system that help preserve the overarching values of unity and stability. The goal of unity is upheld organizationally by the norm that the authority of the top leader (whether a leader at the apex of the system, or the leader of a subordinate organization) remains paramount. As is often expressed informally, "the boss has the last word" (*laoda shuolesuan*), i.e., authority to intercede in a decision, or to change goals. A related mechanism is the signal-response dynamic in which the top leader sends signals identifying broad policy goals, seeking responsive actions from lower cadres. As noted above, when initiating a policy, Chinese leaders very often express goals in vague, highly general terms, most commonly in political slogans that express the "spirit" of the leader's intentions. Maoist slogans such as "serve the people" were replaced in the early post-Mao years by imperatives to "seek truth from facts." Slogans related to the 863 program include the need to "catch up to the West in science and technology" (hereafter S&T), to "leapfrog" to benefit China's industrialization and commercialization, and to promote "indigenous innovation." Lower level cadres, seeking to claim they possess authority from the leader will offer policy responses they hope are consistent with the spirit of the leader's signal. But because leaders' signals lack specific guidance, often for months until more detailed regulations are issued, subordinates generally must respond without a full understanding of what the leader actually wants.<sup>8</sup> When signals change, even if not bundled with any formal rule changes, cadres must respond once again, "muddling through" to meet multiple unstable targets (Zhou et al. 2013).

The need for the boss to have the "last word" and the signal-response mechanism in turn foster two additional, interrelated types of uncertainty that strongly shape the bureaucratic environment.<sup>9</sup> The first is muddled organizational responsibilities. Despite detailed bureaucratic organizational maps that imply a clear chain of command and specified roles and responsibilities, in the typical post-Mao organization departmental functions overlap substantially. Overlapping responsibilities combined with frequent rotation of positions (albeit based on competitive and merit-based criteria; Landry 2008) create space for leaders to be involved in decisions at all levels, ever retaining the ability to have the "last word" and limiting true delegation to agents. In this environment, lower level cadres have poorly defined bounds of authority and are unable to make decisions based on clear and consistent rules, as those rules may turn out to be contrary to the (future and evolving) signals of higher level leaders. This dynamic also fosters the constant negotiation highlighted by the fragmented authoritarianism model. An additional form of uncertainty is found in the deliberate ambiguity leaders

maintain by creating “available zones of uncertainty” (Crozier and Friedberg 1980; Kuhn 1987), including flexibility in implementing rules and space for negotiation. By frequently changing rules and requiring coordination with other overlapping units (in contrast to a rationalist ideal of stable and codified rules), bosses create uncertainty, but also the option for flexibility. It is this flexibility that allows both bosses and subordinates to find ways to show responsiveness to changing signals.

Thus, we emphasize that the context created by leaders’ broad signals and incomplete delegation, as well as various forms of uncertainty, are key features of the post-Mao bureaucratic system, a system in which subordinate cadres must keep “running” to meet multiple unstable targets and complicated pressures. While this system is not inconsistent with the behavioral consequences suggested by fragmented authoritarianism, in our view the fragmentation and need for bargaining is enforced by the leader, and leaves the leader in a position to judge and intervene in the outcome. The setting of vague, changeable, and soft organizational rules and boundaries, which reserve high levels of discretion for leaders but demand responses by lower cadres means organizational power is not explicitly or clearly distributed (except at the apex of the system)—in sharp contrast to the Weberian ideal.

In contrast to perceptions that Chinese bureaucratic culture is static, we identify sources of flexibility that, albeit incremental, show a “hybrid adaptive” organization that evolves over time. The following analysis of the 863 program will show that leaders applied rational-instrumental principles—including putting science experts in charge—as a “band-aid” over the extant bureaucratic system. Historical institutionalism provides us a useful angle to understand the transition; as we shall see, in its effort to move China’s S&T system forward quickly, China’s leadership attempted to push aside the existing bureaucratic procedures. Most of the new processes were not sustained over time, however, and signal-response type mechanisms eventually reemerged. This story might at first glance seem to vindicate the perception of a moribund bureaucracy. However, some of the new norms have become entrenched, and in a rough sense “layered” onto the system, providing a source of incremental change.

In sum, we argue that three features operate in the dominant post-Mao bureaucratic system: the influence of overarching core values (unity and stability), signal-response control mechanisms linking leaders and cadres, and institutionalized uncertainty. This is not a system that functions well in the face of urgent challenges, however. To address such challenges, China’s bureaucracy requires a nudge from outside the system. For post-Mao Chinese leaders, rational-instrumental tools have been one choice method when urgent intervention is needed. Despite the difficulty of institutionalizing new tools, they have not been fully discarded; genuine learning from these values has also entered the system. While efficiency, predictability and operational transparency are often lacking in this hybrid system, the positive side is the ability for leaders to be flexible, and for the system to adapt.

### **The 30-Year Evolution of China’s 863 Program**

In 1986, the Chinese government initiated a bold move to address China’s relative weakness in S&T. (Feigenbaum 2003; Ru 2012; Zhi 2012). China’s National High Technology Research and Development Program, commonly referred to as the “863 Program,” was bold insofar as it was to be the highest profile policy tool for promoting China’s technological rise, and would draw on considerable state resources. It also was bold in its bureaucratic design; in its radical application of Weberian organizational principles, 863 was explicitly intended to break the shackles of the existing



ministerial routines. The program provided for a relatively insulated group of scientists to carry out clearly specified goals with a minimum of bureaucratic interference. Yet 15 years after its founding, the program's expert-driven model had seriously deteriorated. The organization became guided by increasingly vague principles, and by processes that both sidelined the scientists to consultative roles and undermined the expert-led decision structure. Implementing officials faced increased uncertainty, while a greater role was carved out for ministerial-level political "bosses" who themselves had to interpret vague signals received from the country's top leaders. By 2000, then, the S&T bureaucracy once again was behaving much as other post-Mao bureaucracies did. Having basked in the glow of a stellar reputation for years, 863 finally succumbed to criticism of ineffectiveness and cronyism, and was ended in 2016. What happened? Unsurprisingly, the program was beset by bureaucratic drift, as might be seen anywhere when a high-profile project loses leaders' attention and urgency. But the 863 case also offers a window into more enduring characteristics of Chinese bureaucratic behavior. This section describes the program's original goals and design, and its subsequent deterioration through four phases.

### **Origins of the 863 Program**

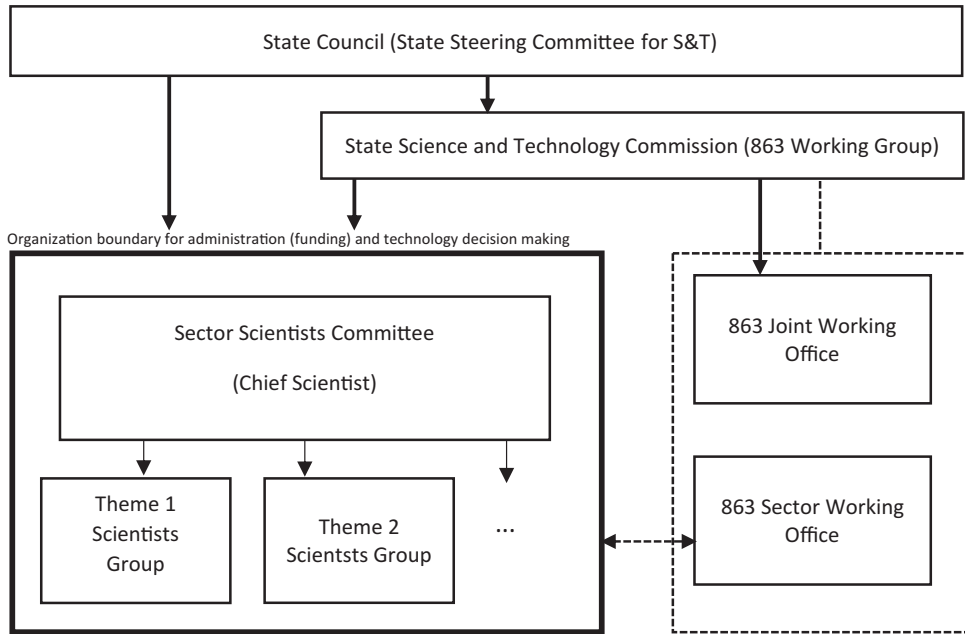
The origins of the 863 program lie with the decision of top reform leaders that China faced an urgent need to "catch up" internationally in technology areas such as information, biotechnology, and energy. Deng Xiaoping launched the program in March 1986 (giving rise to the moniker "863"), persuaded by influential Chinese scientists that R&D systems for China's high-end technology needed to face the "shock" of the U.S. Strategic Defense Initiative Program ("Star Wars"), as well as similar S&T programs being undertaken by the Soviet Union, Japan, and Europe. The founding scientists believed this ambitious goal could not be achieved in China's existing organizational system. They proposed to construct an insulated organization within the government, to be managed by professional scientists. Deng Xiaoping provided explicit leadership authority, writing across the proposal: "This suggestion is very important. Please ask [Premier Zhao] Ziyang to hold discussions with experts . . . and make a decision. The decision making should be rapid. Do not delay" (Ru 2012, 66). The ensuing "Outlines of the 863 Program" document (hereafter 1986 Outlines) was put forth at the highest levels of the party-state—approved by an expanded meeting of the Politburo and published in the name of both the Central Committee and the State Council. The scheme incorporated several core aspects of Weber's ideal-type bureaucracy: authority for the task derived from codified documents and political leadership, programs assigned to units according to rational schemes and with minimum overlap, and assignment of tasks according to merit and technical expertise.

### **Phase 1: Constructing a Weberian Organization, 1986–1991**

From the earliest days of 863, the program's expert leaders set the goal of "catching up to state-of-the-art technologies that have great potential in the future to facilitate economic development." To clarify the signals, the 1986 Outlines focused attention on seven high-tech sectors—biotech, space, information, laser, automation, energy, and new materials—and set 15 priority technology themes. Thus, in its origins 863 set specific technology goals that were clearly identified, and possessed legal force.

In terms of managerial structure, the Outlines stressed that scientists, hired according to merit, were to have decision-making authority for the program (see Figure 1). To streamline the organizational hierarchy, the program was to be guided directly by

FIGURE 1  
**Founding, Phase 1 (1986–1991)**



a single office within the State Council (the State Steering Committee for S&T), and implemented directly by the 863 Working Group within the State Science and Technology Commission (SSTC<sup>10</sup>) led by the minister of SSTC. Subsequent implementing instructions, the 1987 “Opinion on Implementing the 863 Program Outlines” (hereafter 1987 Opinion) further clarified that the core management body with decision-making authority would be the Sector Scientists Committee, which would oversee Theme Scientists groups. These committees were to have clear boundaries: “The scientists committees (groups) are the integrated institution for *both* administration and technology orders” (emphasis added) (General Office of State Council 1987). Meanwhile, members of the Scientists Committee could directly communicate with existing R&D institutes outside the 863 Program and contract with them for technology projects, thereby bypassing both these institutes’ superior ministries and the “departmental cutting system” (described below) used for funding allocations. To coordinate between the SSTC’s 863 Working Group and the scientist-based management groups, SSTC established two relatively weak administrative offices, the 863 Joint Working Office and the 863 Sector Working Office, which would carry out routine administrative work for the 863 Working Group, and communicate with the program’s scientists’ organizations. They did not possess substantial decision-making authority. In Figure 1 the dark bolded lines delineate the strong boundary for funding and technology decision making, showing the relatively insulated organizational authority of the scientists, an insulation that would change over time.

The 1987 Opinion also formalized routines. The most important new routine was to create a clear flow for funding allocations, mandating that funds would come directly from the Ministry of Finance to the State Council S&T Steering Committee, to the chief scientist, and finally to the project investigator. Though not pressing for

elimination of competing ministries, the 1987 Opinion amounted to an end-run around the funding allocation system normally dominant in the S&T arena. The founding scientists had argued that the Soviet-style “departmental cutting” system—by which funds were divided between all relevant ministries, then within relevant ministerial departments, and finally between relevant interior units—failed to promote rapid technology development. Such funding allocations were not tied to performance but, rather, were designed mainly to keep funds *inside* a given bureau. As one official stated with regard to “normal” funding of integrated circuit research, “Usually, 80% of the budget remained on the inside, while 20% was used to fund research institutions all over the country that were doing research on a large integrated circuit scale” (reported in Ru 2012, 75).

Thus, the 863 program’s goals of placing important scientists rather than political cadres in charge of project choices using a new funding protocol won out. As a later (1995) SSTC white paper emphasized, “The core of the reform under the 863 plan is reform of the fund appropriation system and expert participation in decision-making” (quoted in Feigenbaum 2003, 172). New norms for funding projects according to merit-based decisions were instituted. In this early phase, offices that had been cut out of the new system sometimes tried via the administrative “863 Working Office” to interfere with decision making by the scientists’ groups, but such efforts were thwarted.

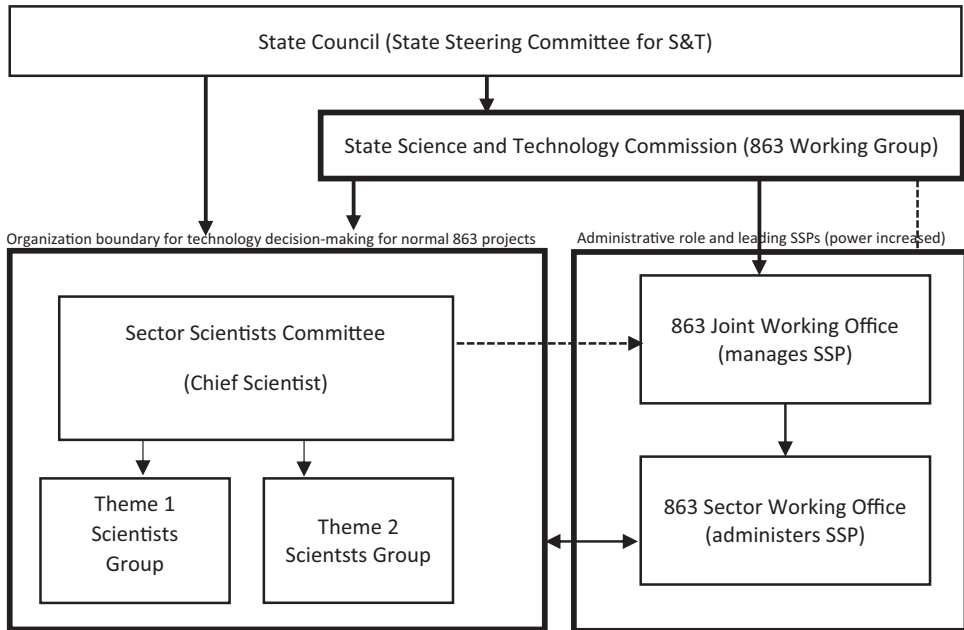
## Phase 2: Success, New Signals, and Early Deterioration, 1992–2000

863’s second phase (1992–2000) continued many features of the first period, reflecting in part that the original mandate of the 1986 Outlines was valid for 15 years. Moreover, the program was deemed to have made a positive impact on China’s S&T development, and so was used by Beijing as an institutional prototype for other national S&T programs launched in this period, including the Torch Program, the Spark Program, the National New Products Program, and so on (Zhi 2012). Following from the procedures prototyped in 863, these newer initiatives gradually replaced the “department cutting” system and transformed S&T funding allocation to a competition-based mechanism throughout the government, illustrating a lasting impact of the original “band-aid” layer.

Although many of the new norms remained in this phase, including substantial reliance on expert decision-making authority, 863 was increasingly infiltrated by values of the dominant system. The signals from central leaders evolved in this phase to become vaguer. It is true that the fall of the Soviet Union in 1991 came as a shock to the Chinese leadership, spurring further pressure on the post-Mao reforms to deliver stability. For S&T, however, the end of the Cold War relaxed somewhat the competition over defense-related high technology. Instead, China’s leaders focused even more on economic growth. Based on Deng’s signaling 1991 statement that the 863 and Torch programs should “develop high technology, realize industrialization,” government R&D programs now were to focus on civilian industrialization and commercialization of technology. The 863 program would have to make adjustments based on a new slogan in which no specific technological priorities were stated. Moreover, new goals were layered on top of the old ones. Because the 1986 Outlines remained the founding document, and the goals set in the first period remained in effect, SSTC needed a flexible approach to respond to evolving signals. Defense-related high technology projects were to continue as in the first phase. But to respond to the center’s new yet vaguer call, the solution was creation of a new “available zone” of uncertainty: a new category of projects under the framework of 863, the Significant Special



FIGURE 2  
Evolution, Phase 2 (1992–2000)



Projects (SSP). Thirty-eight SSPs were designated, with the aim of building prototypes of key industrial technology products such as high-performance computers.

New 1992 implementing "Opinions," launched jointly by State Council and SSTC, directly altered the organizational principles, and in particular some core elements of the scientist-managed organization. The language mandating the principle that "scientist committees (groups) are the institution for technology orders" remained from the 1987 document, but eliminated "administration" from the scientists' decision authority. This important change eroded scientists' authority over major decisions over the new SSPs, including funding allocation, and gave this power to the previously weak 863 Joint Working Office and 863 Sector Working Office. With these changes, the managerial boundaries of the expert-run organization started to become hazy. Specifically, for new projects under SSP, the previously "in charge" Sector Scientists Committees became mere sources for technological suggestions and consulting to the Joint Working Office. Just as important, the 863 Working Group in SSTC was placed in charge of the decision-making function for all of 863, so had greatly increased power to influence decision making in the two levels of scientist management organization. These changes are shown in Figure 2, with loci of authority once again demarcated by the bolded lines. In this second phase, the former "helper" working offices came to play a significant role in decision making under a newly strengthened leadership role of the SSTC.

Management of the new SSP program therefore reversed the practice of the first stage, as the Joint Working Office and the Sector Working Office under SSTC were now assigned substantial authority, and the Scientists Committee and theme groups were reassigned as consultants. Conversely, the SSP did quickly respond to the central leader's changed priority to favor industrialization and commercialization of

technology. For example, starting from 1994 the output of the entire 863 program in intellectual property and technology product prototypes quickly increased. SSTC cadres—who entered the organization based on civil service exams rather than from academia—argued they were more capable than the “ivory tower” scientists at responding to the changing goals of central leaders, who wished for achievements in S&T to be widely disseminated to promote industrialization.

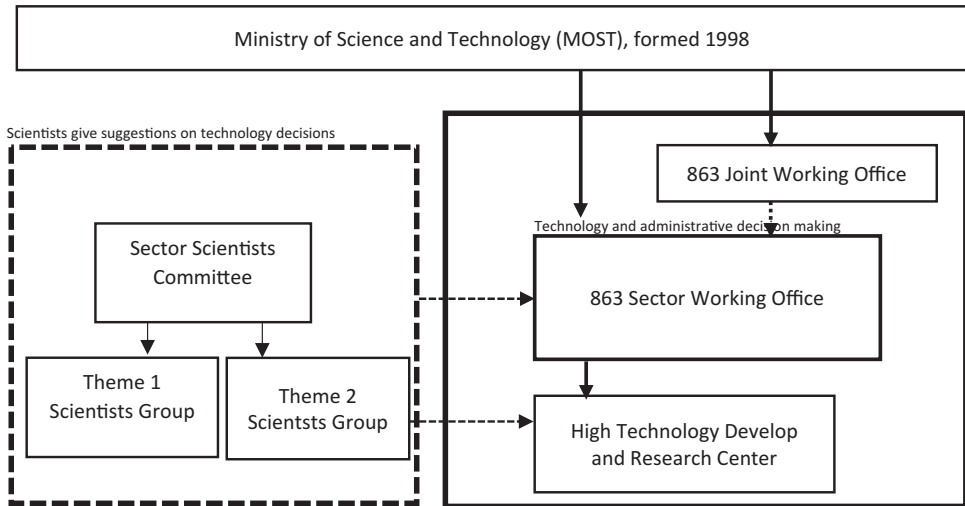
SSTC, which previously had mainly a broad oversight role, also was able during this second phase to blur the boundary of the 863 program management and increase its own influence in decision making. Other national S&T programs such as Torch and Spark, though supposedly launched on the model of 863, in fact were led by the SSTC, further facilitating SSTC’s rapid expansion in scope and power. The denouement of SSTC’s expansion effort came in the context of Premier Zhu Rongji’s major 1998 administrative reform. Whereas Zhu’s reform was primarily focused on eliminating ministries to streamline the bureaucracy, the singular exception was to create, from SSTC, a new and powerful Ministry of Science and Technology (MOST). Unsurprisingly, the new central signals favoring industrialization, carried out via SSPs, were reflected in budget allocations. From 1994 to 2000, more than 50% of the 863 program budget was spent on the SSPs, while 35% of the budget was retained for the so-called normal 863 projects. The remaining 15% was newly reserved for SSTC as flexible funds, to be used to react to possible (yet uncertain) new national priorities. (Ru 2012, 92–93).

Overall, the first 15 years of the 863 program successfully transformed the central government’s S&T function from the problematic “department cutting” funding system run by political cadres into a merit-based system that could bypass multidepartmental interests and integrate cross-departmental R&D forces more efficiently. In addition, the scientists were widely involved in decisions on priorities and allocation of funds, thereby creating a new norm of expert control. In this sense, the bureaucratic system “learned” new expert-based norms over the first two phases. During this period, moreover, the 863 program was deemed to have achieved substantial success toward the two overarching policy goals: in the first phase, narrowing the high-end technology gap, and in the second phase, creating products conducive to industrialization. But while 863 garnered a very strong reputation as the “flag of China’s high-tech development,” after 15 years the erosion of the insulated expert bureaucracy and resurgence of top-down control by political cadres had begun to take hold.

### **Phase 3: Deterioration of the 863 Vision, 2001–2005**

By 2001, the basis of legitimacy for the 863 model was being challenged. President Jiang Zemin, appointed in 2002, did not continue Deng’s heavy emphasis on the program. Moreover, after 15 years the legal foundation provided by the 1986 Outlines had expired. It was not clear whether and how the 863 program would continue. MOST, SSTC’s successor, in March 2001 organized a huge exhibition of 863’s achievements from the first 15 years. The exhibition, which was visited by President Jiang, would demonstrate cadres’ responses to previous central signals. Successful, MOST received approval to continue the program as a long-term R&D channel. Approval was accompanied by a major increase in budget—in the 5 years from 2001 to 2005, the budget of 15 billion renminbi (RMB) exceeded the total budget of its first 15 years. In 2001, the State Council issued new “Outlines for the 863 Program” that listed the technology priorities as economic development, industrialization, and commercialization. The breadth of these goals contrasted with the

FIGURE 3  
Deterioration, Phase 3 (2001–2005)



specificity of the early 863 directives. With regard to organization, the new Outlines stressed that the 863 program should reflect the overall leadership of the government (MOST), which meant that specific management policies were to be made by top leaders of MOST. The legal basis of “scientific experts in charge” therefore lost its codified legitimacy and was supplanted by the leadership agenda of a massively expanded ministry. The organizational locus of authority within the bureaucracy also changed in the third phase. As shown in Figure 3, the 863 Sector Working Office became the core decision-making bureau in the program, while the two levels of scientists’ organization devolved into an advisory organization for the Sector Working Office.

At the same time, MOST cadres became highly attuned to the attention of central leaders. During this period, in which China’s WTO accession was a major focus, Beijing announced several strategies (i.e., sent new signals), including goals to “develop high technology, realize industrialization, enhance sustainable S&T innovation capability, and achieve leapfrogging technology development,” and announced the “Talent, Patent and Technical Standard” strategy. MOST leaders interpreted these rapid—and somewhat vague—changes in strategic orientation as requiring it to take over decision making from scientists. As explained by MOST Minister Xu Guanhua, “The reason that the government increased its control on decision-making in the 863 Program is that the national strategic orientation was enhanced and needed to be dynamically adaptive to the national and political thinking, which exceeded the level of S&T” (Xu 2007). Even though President Jiang did not pay close attention to 863, he nevertheless kept the “last word” by looking for responses to the government’s signals. Minister Xu responded using the flexibility provided in the vague slogan’s “zone of uncertainty” to emphasize “leapfrogging” strategies from among the various slogans. “Leapfrogging” was interpreted to permit the flexible integration of both foreign and domestic technology to produce new products. The underlying aim was to increase the size of SSPs and number of patents obtained, and establish new technology standards.

Although the Sector Working Office became the key decision-making bureau, minister-level leaders reserved authority for final approval—thereby ensuring a response from cadres—by setting bureaucratic procedures for each project. Decisions on 863 projects now were channeled into a long and complicated administrative flow that further sidelined scientists. Every project now needed to be approved by each level of the ministry, from sector office (bureau level), to joint working office level (department level), and finally approved by the minister level. Although this decision process was not efficient, it gave leaders at each level the authority and flexibility to influence decisions (Zhi et al. 2013). Consistent with the theory of fragmented authoritarianism, each level was now able to halt the procedure and return the proposal to the sector office with their suggestions when they did not agree. In short, these moves muddled organizational responsibility, created substantial organizational uncertainty, and yet allowed the leader (boss) to continually monitor responses.

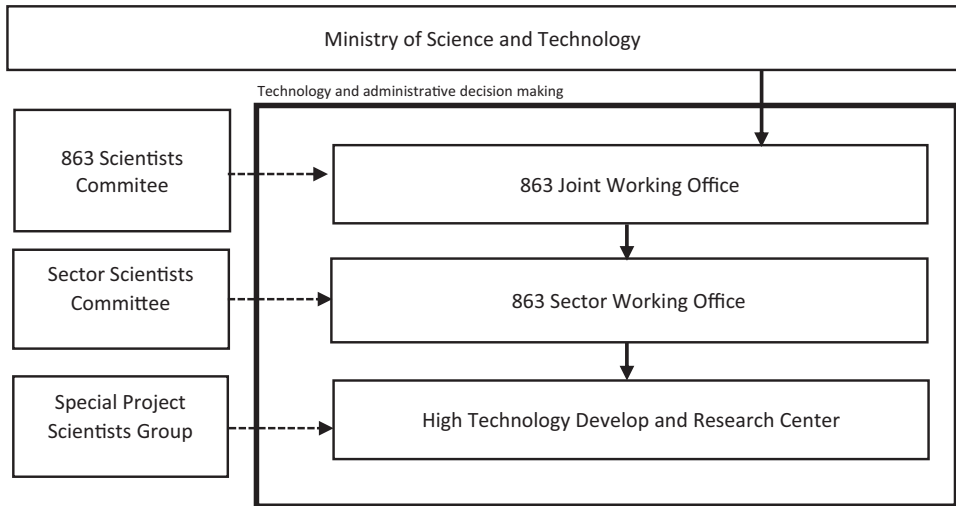
#### **Phase 4: Elimination of the Scientist-Driven System, 2006–2014**

In 2006, MOST published new “Management Measures for the 863 Program.” This document further diminished the standing of the scientists’ groups and deepened uncertainty even further through creation of an extreme overlapping organizational structure. Whereas previously the Sector Scientist Committee had directly managed the theme scientists, starting in the fourth phase the theme organizations were dismantled and their scientists were involved in the decision process only as outside advisors (see Figure 4). In the words of a retired SSTC and MOST official, the new MOST leadership now had “a basic philosophy about who should decide the direction of science and technology: state, or scientists?... Government officials think, ‘we [government cadres] invest, so we should decide.’ In high-tech research, science [now] follows the government.”

The Politburo released the medium- and long-term plan for science and technology development (2006–2020) (MLP) in January 2006. The MLP advocated the promotion of stronger capabilities for “indigenous innovation,” and President Hu Jintao stated China’s intention to become an “innovation-oriented country.” The definition of “indigenous innovation” was never clear, however. Absent a clear goal set by paramount leaders for the ministry “boss,” then, goal setting in the 863 program became even vaguer.

Meanwhile, other important affairs—most notably China’s hosting of the 2008 Beijing Olympic Games—took center stage in Beijing’s agenda. MOST, with authority over 16 different national S&T programs, had to demonstrate responsiveness to new central priorities, even if the connection between technology policy and Beijing’s agenda was not always obvious. At the same time, the bureaus inside MOST parallel-operated the numerous different programs simultaneously. Each department was incorporated into the decision process, and every cadre was required to be involved in the procedures of multiple programs. New complexity infused the “operation procedures”—the process by which each of the 2,841 projects (in 2006) was to be decided and monitored. Note in Figure 5 that, in stark contrast to the streamlined decision processes originally envisioned for the 863 program, the “helper” offices from the first phase—the 863 Joint Working Office, and 863 Sector Working Office—plus the minister’s main administrative departments all became involved at multiple levels. This lengthened procedure, characterized by many stages and extensive organizational overlap, created substantial uncertainty for cadres in charge of implementation, and exemplifies the very complicated “running” system for cadres.

FIGURE 4  
Elimination, Phase 4 (2006–2014)

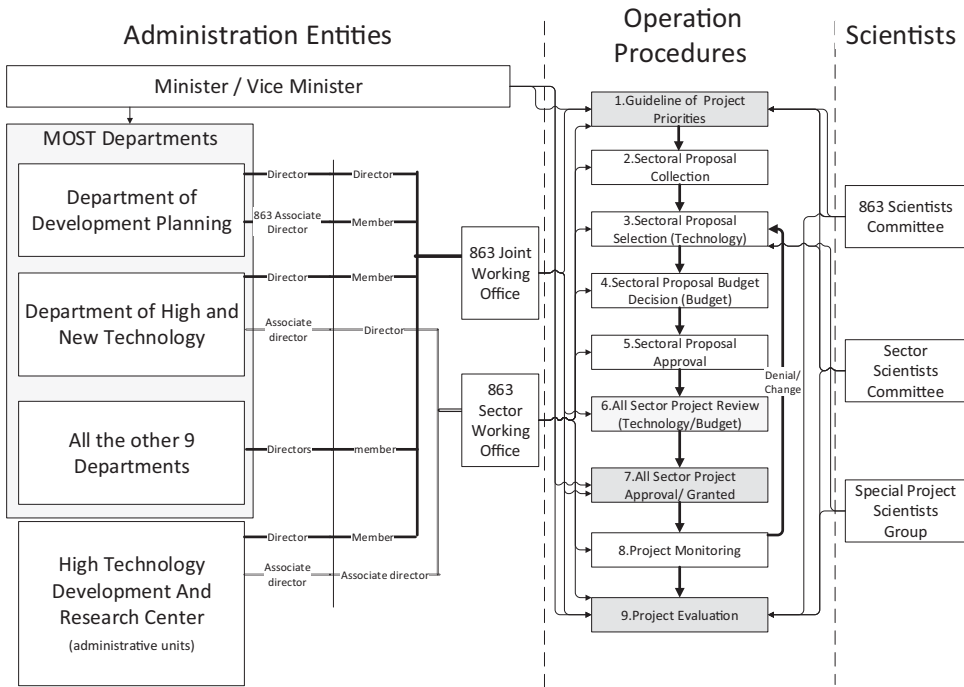


An example of how this highly inefficient “running” response to vague signals played out is the SSP for new energy vehicles (NEVs). In 2007, when Wan Gang (an expert on NEVs) was appointed minister of MOST, the most important political priority was the preparation for the 2008 Beijing Olympic Games (and later the World Expo in Shanghai 2010). Building on his expertise and wishing to show a quick response to the signals of “indigenous innovation” and “an innovation-oriented country” as well as having a showpiece for what were to be the “Green Olympics,” Wan promoted massive research programs on NEVs. NEVs quickly became 863’s biggest SSP, with a 7.5 billion RMB budget allocated among 432 organizations, including universities, firms, and research institutes. (Indeed, a no-holds-barred effort would be required given the tight time frame before the August 2008 Olympics.) MOST’s Transportation Sector Working Office (TSWO), assigned to lead all transportation-related technology priorities, oversaw a new SSP Office for NEVs (SONEV), which itself would coordinate between different departments and directly report to Minister Wan (allowing him the “last word”).

Examining merely the *first* step in the nine-stage operation procedures (see Figure 5), establishing the “Guidelines” for setting NEV priorities, we get a glimpse into the procedural morass. First, TSWO directed a scientists’ group to collect preliminary suggestions as to guidelines. They responded to Minister Wan’s signals by suggesting NEV demonstration projects for the upcoming Olympics and World Expo. Next, SONEV organized discussions about the feasibility of the guidelines, and suggested revisions. Third, the proposed guidelines were submitted to the finance department to verify budget, at which point the proposal was changed and sent back to the TSWO. Fourth, once having passed the fiscal planning process, the proposed guidelines went to the 863 Joint Working Office to be approved by Minister Wan; any revisions requested at this level would return it back to the previous stage in step 1. Once finally approved, formal “Guidelines” were announced publicly and allowed to move to the next step. Step 2—in which sector offices collect project proposals from research



FIGURE 5  
863 Organizational and Personnel Program Management, 2006–2010



entities—initiated a similar long-chain process. This elongated and inefficient approach to decisions on NEVs occurred not just in the SSP but also for all programs within MOST. We can imagine these procedures as sending cadre “particles” circling different levels of a metaphorical vortex. The minister (“boss”) could of course intervene in this process by offering a green light to bypass different levels; indeed, the Olympic Games demonstration project was approved in less than a month, whereas other projects took more than 200 days to pass steps 1 through 7.<sup>11</sup> 863’s decision-making and organizational process obviously had moved far from the original streamlined intent.

Also creating uncertainty was the separation of budget decisions (step 4) from technology decisions (step 3). In 863’s earlier phases, budget decisions had been made by scientists in the section offices. Interviewees in departments that now made only the technology decisions complained about this new separation: “The Division of Budget does not understand the technology at all, so how could they judge the budget?” Also frustrating to them was the “many bosses” phenomenon in which different superior officials reviewed a project at different stages; steps 3–7 were judged by three different bosses.<sup>12</sup>

The increase in complexity reflected several trends. Because of the increasing work-load for cadres, given their simultaneous oversight of multiple programs, MOST leaders specified routines to ensure the programs were operating. The strategy was to use overlapping divisions of labor between bureaus. Meanwhile, because it was incumbent upon top MOST officials to show responsiveness to the political agenda—“indigenous innovation,” the 2008 Beijing Olympic Games, climate change, and so on—they appeared to promote greater flexibility to intervene in decisions.

MOST leaders also appeared to lack confidence that scientists could “read”—be adequately responsive to—the top leaders’ desires, and argued in effect that they themselves, as political cadres, could know better the societal and economic needs and conditions. In short, the system preserved the leader’s “last word.” The rapid change in national priorities, the lack of clarity about how exactly goals should be carried out (and be evaluated), and the vastly increased complexity of decision making with many turn-back points, all deepened uncertainty within the organization.

### Conclusion

Leaders’ deployment of rational-instrumental bureaucratic tools to implement the 863 program succeeded at the start of the program, and into the second phase, but was not sustained. The deterioration of these tools came about as a result of several forces. First, the agenda set by China’s topmost leaders evolved from making scientific advances that responded to an external security threat toward the idea that S&T innovation should be widely diffused for broad economic development and creation of a commercial market. This change made a radical fix from a rational-instrumental band-aid less urgent and, probably, less viable. Perhaps the perceived diminution of this external threat alone would have corroded the rational-instrumental model. But it is clear that the evolving context also created incentives for political cadres within MOST to resurrect more traditional bureaucratic behavior according to the signal-response mechanism. Ministry cadres, oriented to responding to signals sent by leaders, found the chance to grab authority previously held by experts. The ability to demonstrate to superiors that they were responding to new signals by fostering S&T development (whether their projects were actually doing so or not) took priority. Along with the sidelining of scientists in decision making and the return of cadre bosses, the old overlapping structure and adherence to the norm of “the boss has the last word” returned. As correctly depicted in the theory of fragmented authoritarianism, all relevant actors once again had a place at the table, ready to bargain for their share of available funds once they could make a case to the “boss” that they were responding to national goals. In addition to changes in organizational structure, however, we emphasize the impact of uncertainty on cadres’ behavior. When cadres must respond to vague, frequently shifting goals, they operate in an unclear environment. The most important consideration (including for promotions) is to avoid incorrect responses or being seen as slow to respond. They thus take quick initiatives in hope that leaders will approve, as in the MOST minister’s promotion of electric vehicles. It is not hard to see why the image of a vortex describes the cadre experience in China’s bureaucratic system; cadres become like “particles” running in circles.

The metaphor of the vortex also implies a silver lining: that the Chinese post-Mao system is far from static. Indeed, this dynamism, even with uncertainty, arguably has functional qualities. The impulse to respond to the goals set by political leaders outside the bureaucracy is appropriate, as Weber recognized. In the signal-response mechanism, the uncertainty/challenge political leaders themselves face is distributed and “digested” inside the bureaucratic system. Most important, perhaps, when it is not specified how goals and slogans articulated by top leaders should be operationalized, subordinates have some flexibility in how they respond. They can perhaps innovate according to local conditions or new ideas. At the same time, flexibility within the system—and the ability to layer on new processes through band-aids—allows adaptations that may improve the system while at the same time avoid being seen as

challenging the ultimate values of stability and unity under party rule. In the case of the 863 program, through the layering on of new processes, certain norms of the rational-instrumental agenda have been quite deeply incorporated. Chief among these is the prevalence of competitive and merit-based funding procedures; such procedures are now much more hard-wired into the system, as compared to the previous “cutting system.” In this sense, Weberian norms have not been wholly sidelined in decision making. China is moving toward a hybrid system in which rationalist values are gradually being incorporated to balance the more standard post-Mao practices.

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### Notes

1. Numerous useful studies describe the interface between the central state and societal/local actors (e.g., Hsueh 2016; Mertha 2008; Tsai 2006).
2. Related discussions are Zhou et al. (2013) and Huang (2013).
3. Our use of the term “adaptive” differs from scholarship emphasizing a tradition of bottom-up local influence on the bureaucracy (e.g., Heilmann and Perry 2011), or the use of informal means to overcome institutional constraints, means that later become institutionalized (Tsai 2006). In contrast, we use the term to denote flexibility within the central bureaucracy during a transitional period in which China faces major challenges.
4. Relatedly, Fewsmith (2010) points to the enduring complex interplay of formal and informal rules.
5. Here we are influenced by Heilmann and Perry’s (2011) discussion of the presence of uncertainty and flexibility in China’s policy environment.
6. Although scholarship on Chinese bureaucracy has not ignored international context, it has focused mainly on either how bureaucratic scope has expanded to include international concerns (e.g., foreign investment) or how China has adopted international models such as independent regulators (Pearson 2007). Hsueh (2016) discusses the role of international strategic factors in the arena of market governance.
7. In other words, unity is preserved by either eliminating those who threaten party rule or, more routinely, compromising to maximize winners and minimize losers. The regime’s tendency toward continuous waves of reform preserves the old system (minimizing “losers”) while adding new “band-aids.”
8. A typical example was the issuance of a very general law on joint ventures in 1979, years before detailed implementing regulations were promulgated. Many subordinate officials took the general signal as an opportunity to begin to attract foreign investment (Pearson 1991).
9. Scholars writing on Bureaucratic uncertainty generally have emphasized the complex *policy environment*. Heilmann (2009), for example, notes in China’s reform context that the search for policy responses in the face of complexity-driven uncertainty is an origin of many policy “experiments.” We argue in a somewhat different vein that the *leadership norms* surrounding “bosses” and the resulting *procedural* preferences themselves generate uncertainty for cadres (see also Lindblom 1959; Zhou et al. 2013).
10. As discussed below, in 1998 the SSTC was upgraded to the Ministry of Science and Technology (MOST).
11. On how the demonstration project was completed, given the deadline, with great difficulty and questionable product success, see Tillemann (2015).
12. The procedures depicted in Figure 5 became even more extensive after 2011.

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