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PORTES

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Red Science: China's Scientific Capital and the Future of the Chinese Academy of Sciences

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Arturo Salazar*

Resumen: La Academia China de Ciencias (ACC) genera los adelantos científicos y tecnológicos que convierten a China en uno de los principales centros de innovación científica a nivel mundial. Sin embargo, el férreo control que el gobierno chino impone a la labor científica de la Academia y la tradición del *guanxi* entre sus miembros impide que la ACC asegure un medio propicio para realizar investigaciones innovadoras. El artículo discute la lógica económica del control científico y sus efectos en la Academia China de Ciencias. El objetivo del ensayo es predecir si la ACC seguirá siendo el principal proveedor de innovación científica en China. El enfoque de los “sistemas nacionales de innovación” y las tradiciones culturales heredadas del confucianismo, nos permiten generar conclusiones precisas. El ensayo concluye que la reputación internacional de la Academia China de Ciencias como uno de los principales centros de innovación científica y tecnológica, puede peligrar si el gobierno chino no realiza ciertas reformas críticas.

Palabras clave: China, Academia de Ciencias, investigación científica.

Abstract: The Chinese Academy of Sciences (CAS) produces the scientific and technological breakthroughs that place China among the major players in scientific innovation. However, the control that the Chinese government exerts over the Academy and the tradition of *guanxi* among its members prevent the CAS from take-off and securing a free environment to conduct origi-

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nal research. The article assesses the economic logic of scientific control and its effects within the Chinese Academy of Sciences. The paper's aim is to derive to what extent the CAS will remain as China's main provider of scientific innovation. The "national innovation systems" approach and the cultural traditions rooted in Confucianism are revised in detail to provide an accurate perspective. The paper concludes that the CAS' international reputation as a center of scientific and technological innovation might be at stake unless the Chinese government makes some critical reforms.

Key Words: China, Academy of Sciences, Scientific Research.

Introduction

The Chinese Academy of Sciences is simultaneously charged with providing the national leadership scientific and technological research and expertise and advising decision makers on issues that they consider crucial for China's economic development. This combination of "brain bank" and public agency pressures the CAS in two ways: on the one hand it has to conduct relevant research according to scientific standards, and on the other hand it has to fulfill targets of innovation imposed by the government. How has the Chinese Academy of Sciences managed to overcome these challenges? What are the instruments it uses to prevent the intervention of the State? Does the Chinese scientific elite represent the best and the brightest? Does the control of science really affect the elite?

This paper addresses whether the Chinese Academy of Sciences will continue to be China's maximum provider of scientific innovation. I argue that despite the apparent success of CAS' dual role, the Academy's internal procedures and the government's view of science as an instrument to achieve economic goals constitute significant barriers for the CAS to attain the same level of innovation in the future. The paper concludes that unless the practice of *guanxi* and Confucian values are removed from the Academy, and unless the government gives full independence to academicians, the Chinese Academy of Sciences will not be able to provide creative and original research that makes China a center of international innovation.

The paper draws two basic assumptions: first, the principle of universalism,¹ as opposed to the use of subjective criteria in evaluating academic research, is considered more beneficial to scientific innovation; second, science should be primarily driven

by the pursuit of fact, rather than as a tool for developing practical applications. These assumptions will serve as ideal conditions to evaluate the evolution of the CAS and its pending reforms.

Today, the principle of universalism predominantly guides the election of new CAS members. However, personal relationships and pupil-mentor loyalty are still used, to an extent, to advance personal agendas. Similarly, science has been used by the government as an instrument to achieve its security and economic goals. This paper states that the approach of “national innovation systems,” linking science to economic and security matters provided the basis for the Chinese government to direct the work of CAS.

These preliminary conclusions by no means signify that the CAS and its scientific achievements are null, but rather that in order to achieve sustained innovation further steps are needed. It would not be surprising that the CAS lag behind in the near future if its activities remain subjected to short-term development targets, which to a certain extent reinforces the members' reliance to observe the rules of universalism adopted by the international scientific community.

The CAS in a Nutshell

Due to a scarcity of information and to its relatively short existence, relatively little research exists on the CAS.² Founded in 1949, it was not until 1987 that the CAS began to operate with some autonomy from the state. In 1994 it established an honorific membership system (*yanshi*). Probably because of this delay, scholars of scientific communities ignored the CAS since they took honorific membership as a basic indicator of recognition and independence, both of which the CAS lacked during the Mao era. Only after 1994 did CAS members possess a reputation similar to that enjoyed by their counterparts in the National Academy of Sciences in the United States and the Royal Society in the United Kingdom (Cong 2004: 14).

It is impossible to understand the evolution of the Chinese Academy of Sciences without the work of Cong Cao. Cong's main contribution is a study of China's scientific elite from a social stratification perspective.³ Closely related is the principle of universalism in science, which he considers the principal criteria to evaluate the degree of stratification within scientific communities around the world. In sum, Cong's hypothesis is that China's scientific community has moved from the particular/

elitist criteria of evaluation of prospective members to a more universal criterion where only scientific achievements count. The adoption of universalism thus allows observers to make comparisons between China's scientific community and its counterparts in the West where universalism is a widely accepted principle of membership among Science Academies. Whether or not this principle has always been followed by the Chinese Academy of Sciences is debatable, the same can be said of western academies where social origins and institutional affiliation played an important role in admit new members during certain periods of time (Cong 2002; 2004). However as Cong shows, in the last twenty years the CAS has demonstrated its full commitment to universalism in two ways: first, by strengthening the selection process of new members; and second, by opposing the intervention of the state in scientific matters. This leads the author to conclude that universalism will continue to be used in the future and that China's scientific community has the basis to provide the country with quality scientific achievements.

Theoretically, China's scientific elite should be composed of the best and brightest regardless of social, institutional⁴ or political origins. Additionally, scientific achievements should be primarily guided by the drive to advance the state of science. However, it is difficult to observe whether this is the case in reality: cultural factors and continued state intervention may influence the degree of compliance with the universalism principle. Therefore, a complimentary study of such cultural factors and the instrumental meaning that the government assigns to science might give us a more realistic picture of the CAS.

Science as an instrument of the state

Since the triumph of the Communist Party, science and scientists have been used to achieve the priorities of the state. From 1949-1978 scientific capital was used to achieve security goals. From 1978 onwards it has been the driving force behind China's economic development. This section reviews the approach of "systems of innovation" and contrasts it with the official discourse in order to test the hypothesis that the Chinese Academy of Sciences has been limited in its disciplinary scope.⁵

The National Innovation System (NIS) approach emerged in the 1980s as an alternative to the neo-classical theory of economic growth.⁶ At its heart is the belief that the state should play an active role by allocating resources in technological and innovation

activities for development purposes. The “systems of innovation” approach, as understood by the Chinese leaders, resembles the strategies of Japan and Korea in the earliest stages where science received support from the government for development purposes. In particular, the Chinese observed absorptive capacity, imitation strategies, and the question of technological catching up and leapfrogging (Cheung 2006). A proof of the adoption of NIS by the Chinese government is the latest long-term Science and Technology (S&T) plan that states:

“Our goal in deepening S&T structural reform is to push forward the construction of a sound national innovation system. A national innovation system is a government-directed social system for giving full rein to the basic role of the marketplace in allocating resources and for fostering close links and effective interaction among various types of S&T innovators.” (Cheung 2006).

Whereas the Chinese Academy of Sciences is not mentioned in this paragraph, a revision of some discourses made by Chinese authorities supports the hypothesis that the CAS is limited to developing scientific priorities for the government through the new strategy of “systems of innovation.” In addressing the annual conferences of Academicians of the CAS, the last two leaders of China have explicitly outlined the plans that the Academy *should* do:

“It will be hard for us to be active in fierce international competition unless we accelerate developing our economy and scientific and technological programs. Making breakthroughs in fundamental scientific research requires the strategic vision of what to do and what not to do. At present, the strategy of revitalizing our country through science and education has been deeply rooted in people’s hearts.” (Jiang Zemin, January 2001, *Xinhua News Agency*).

“There are three requirements for the scientific and technological innovation in China. The first is to further make clear the strategic goals for innovation so as to solve major problems in China’s economic and social development. The second is that China should accelerate the build-up of its own scientific and technological innovation system. Thirdly, there should be a further fostering of talented people”. (Hu Jintao, June 2005, *China Daily Information Company*).

What is clear from these statements is that the CAS is limited to work in the disciplines that the government considers are priorities. Such priorities must accelerate the economic development of China as well as improve its international reputation. CAS' leaders make no effort to veil these pressures:

“The academy needs to pay much more attention to potentially profit-gaining technologies, which are mostly welcomed by companies striving to sharpen their global competitiveness” (Lu Yongxiang, President of CAS, March 2005, *Peoples Daily Online*).

“[But] on the one hand, we need the money badly to carry out in-depth structural reform; [and] on the other hand, there is also a great amount of pressure on us because we cannot use a lack of money as an excuse if we fail to come-up with tangible results” (Yan Yixun, CAS vice-president, February 1999, *China Business Information Network*).

The former entails a time bomb for the Chinese leadership: while the latest achievements of CAS have placed it among the major players in international research and innovation, the risk of lagging behind increases as a result of its limited scope of disciplines. This is not a sustainable arrangement and the CAS acknowledges that “original innovation in science will be limited with the orientation towards the state strategic demands” (Lu 2001). As China applies symbolic remedies like the opening of a research center (Suttmeier *et. al.* 2006), the question of whether CAS can continue being the only provider of innovation remains unanswered. As indicated by the cases of NAS in the United States and the Royal Society in the United Kingdom, a zero-boundaries policy on science is a requisite to achieve real innovation. Therefore, unless the CAS gets full independence from the government it is very unlikely that the Chinese scientists provide the level of original research for China to remain a global leader in scientific innovation.

Cultural traditions as barriers to innovation

By 1994, when the CAS adopted a system of professional ranking to end government intervention in its internal selection process, the majority of its members were eager to follow the universalism principle. As Cong states, the fact that the struggle towards the recognition of *yanshi* lasted forty years indicates that the Chinese scientific community were used to universalism

even before the reform of 1994 (2004: 68). However, universalism as a principle of peer election does not signify that the elites behave according to the codes of pure scientific inquiry; in fact some members of the Chinese Academy of Sciences still preserve cultural traditions that hamper innovation.⁷ The use of personal relations (*guanxi*) and other traditional values to advance personal agendas are cultural traditions that play against CAS' role as China's principal provider of scientific innovation.

Guanxi is a strong, widespread and culturally sanctioned strategy for awarding social resources in contemporary China (Cong *et. al.* 1999: 538). The logic of *guanxi* is that one's personal interests are more important than the collective interest. The implications of this behavior are evident: not only is the goal of preserving the best and the brightest threatened, but it might also distort innovation by assigning resources to irrelevant projects instead of funding original research that could advance science in itself. As for the first implication, there are documented cases of *guanxi* in the selection of new CAS members, especially in the form of mentor-student recommendation (Cong *et. al.* 1999: 538). The opportunism of some members that chair national programs and use it to secure funding for their projects is an example of the second implication (Cong 2004: 198).

The influence of mentors on students is another tradition with negative effects on innovation. Rooted in the Confucianism, obedience to mentors implies being deferential and to never question the teacher's authority. This has been used by some CAS members to prevent challenges to their research, avoid competence, and, in extreme cases, to relax while others work for them. Cases such as delaying a student's publications, retaining outstanding students, and even plagiarism, have been found among a few CAS members (Cong 2004: 115, 198). The situation gets worse when students rebel against their mentors because challenging the mentor is considered similar to challenging the father. Such action may even decrease the student's chances to get a new job. The effect on innovation capabilities is quite evident: not only do students fail to surpass their mentors academically, but this social tradition may also prevent them from pursuing independent and original scholarship.

Despite the positive effect that the selection process and the introduction of a code of ethics have had in the autonomy of the Academy, it does not resolve the problem of turning the CAS into

a place of flourishing innovation. Traditions and cultural values play a negative effect in securing a free environment for original research, first because they distort available resources to favor irrelevant projects, and second because they hamper the development of new generations of scientists. Not surprisingly, CAS' main problem is the longevity of its members.

But *guanxi* and the other traditions mentioned above have a deeper explanation: the fact that the CAS is under the government's pressure to produce results in a limited disciplinary scope creates a greater distortion in the structure of incentives of the scientific community. Given the limitation of resources, restricted repertoire of disciplines, and time, scientists focus on safeguarding their careers. This is why the scientific elite adhere to universalism in such a selective way: on the one hand it serves to restrict the membership to the best and the brightest while it creates instability depending on the current technological priorities of the state. In other words, CAS' members promote universalism so far as their disciplines are considered priorities for the state; otherwise they would risk their jobs. From their perspective if new disciplines become a priority for the state, universalism neither assures funding to accomplish the government's targets, nor life-lasting jobs. Following the universal principles would mean –in the best scenario– performing the same targets with less money, or even worse, being fired. The result is a continuing struggle to survive at the cost of making the CAS a latecomer in scientific innovation.

As in the case of governmental control over the CAS, *guanxi* and mentor influence on students are important barriers to innovation. Therefore, unless the CAS can enforce the code of ethics to penalize *guanxi* and unless it encourages its members to allow criticism from their students, the likelihood of innovation to flourish is very low.

Conclusion

The paper's aim was to respond to what extent the CAS will continue to be the maximum provider of scientific innovation in China. Given the government's instrumental view of science and the practice of *guanxi* and other traditional values it is plausible to conclude that the future of the Chinese Academy of Sciences as China's national center of innovation will be in danger unless those factors are removed. The likelihood of this to happen, however, is very low because the Chinese Communist Party still

believes that the middle class –intellectuals included– could pose a political threat (Cong 2004: 196). The control over the CAS disciplinary scope is one indicator of such paranoid perceptions although there is no doubt that this control has served more for the pragmatic purpose of developing the economy through science and technology.

As noted above, the utilitarian control of CAS disciplines has hampered full compliance with the principle of universalism. The problem of cultural traditions in this context is difficult to overcome because current members are afraid of being displaced by other disciplines while at the same time they must fulfill the targets imposed by the government. Therefore any means to secure their careers –including *guanxi* and exploitation of student loyalty– are better than adhering to the uncertainties of universalism. While this solution may keep both players content, it prevents the CAS from espousing innovative new ideas.

Cong's conclusion is that the cultural environment where science operates in China stops innovation. The scientists' preference of short-term reachable projects, the obedience of students to mentors, the favor of age in career promotion and the intolerance of failure are aspects that restrain the renaissance of Chinese science (Cong 2004: 203). While the former is true, it is fair to recognize that it depends on eliminating the control over the CAS' disciplinary scope. As long as the Chinese government continues to dictate the scope of inquiry to the Chinese Academy of Sciences, cultural traditions will prevail too and thus, no innovation will occur. The vicious cycle will only be broken if the CAS obtains full independence from the government. But, in the mean time, it is very unlikely to happen. The role of the Chinese Academy of Sciences as China's only provider of innovation depends on this critical reform.

Notes

¹ The norm of universalism requires that a scientist be rewarded in accord to his/her contributions to science and considers personal qualities irrelevant in such judgments (Merton 1973).

² Cao cites two reasons for the paucity of research on this subject: language barriers and triviality (2004: 8)

³ For political and economic variables influencing the CAS consult Goldman & Simon (1989), Suttmeier (1989) and Cheek (1992).

⁴ In China the institutional origin of CAS' candidates refers to the academic unit where candidates conducted research prior to their application for CAS membership. The institutional origin contemplates the same universities, national laboratories and military units (Cong 2002).

⁵ This essay does not revise the first period of scientific submission (1949-1978) because it is widely recognized the control of the State over the CAS and its members. Characteristic of this period is that scientists worked under the military to develop the Conventional and the Strategic Weapons Systems and that the political upheavals such as The Great Leap Forward and the Cultural Revolution ended with a generation of scientists because their knowledge was seen suspicious by the government (Feigenbaum 1999, Cheung 2006).

⁶ Nelson (1993) defines the NIS as “the system of interacting private and public firms, universities and government agencies aiming at the production of science and technology within national borders”.

⁷ For the evolution of election’s procedures within the CAS see Cong Cao and Richard P. Suttmeier (1999), “China’s Brain Bank: Leadership and Elitism in Chinese Science and Engineering”, *Asian Survey*, Vol 39, No. 3, pp. 525-559; and Cong Cao (2004), *China’s Scientific Elite*, London: Routledge.

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