Article

Space Policies of Japan, China and India: Comparative Policy Logic Analysis

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Many people consider that space policy is all about planetary exploration, such as going to Moon or Mars. The most prestigious and glamorous part of space policy is of course the manned-space. The fever of "Hayabusa" in Japan also suggests that even unmanned planetary exploration can be exciting to many in public. Planetary exploration also attracts a lot of attention not only from scientists and engineers. It is therefore considered as the central piece of space policy.

However, the time of space race has been over for many years. The primary motivation for going to the Moon and building Space Shuttle and International Space Station was to compete against the Soviet Union and to demonstrate its technological, scientific and industrial capability. Although manned space exploration did not have direct implication of developing military capabilities (it was and still is prohibited to establish military bases, installations and fortifications, the testing of any type of weapons and the conduct of military manoeuvres on celestial bodies by the Outer Space Treaty), the success of space exploration was considered as a possession of potential military capabilities in space for the future.

Both Soviet Union and the United States spent tremendous amount of money for the planetary exploration. The United States spent more than 4% of federal budget which is equivalent to $900 billion in 2016 budget (Congressional Budgetary Office, 2017). Such large amount of spending for one program in the space policy domain was quite unsustainable. Thus, the Apollo program was cancelled after Apollo 17 launch without completing its initial plan for launching until Apollo 20. For Soviet Union, the technological and financial capabilities were in no match with the United States after the defeat in the Moon race. The investment in space race had certain responsibility for the collapse of the Soviet Union.

In short, the planetary exploration was the name of the game between two superpowers during the Cold War, but when the game was over, planetary exploration had to face with a lot of difficulties.

Meanwhile, the planetary exploration has shifted back in the game of emerging powers such as China and India. China has successfully launched its first manned flight in 2003 and sending Moon probe and landers. India also demonstrating its capabilities to be the first Asian country to send probe to Mars. Why are they suddenly emerged as the emerging power to enter into planetary exploration? What are their motivations? Is there new space race in Asia? This article aims to answer these questions by focusing on their intentions and

discourse of space exploration. In so doing, this article employs an analytical framework which was developed in my previous research (Suzuki, 2003).

Policy Logics for Space Exploration

Policy logic analysis regards policy as an outcome of competition of 'logics'. Actors in policy-making process rely on particular logic to pursue certain programmes, policies or strategies. On the one hand, decision makers have their own policy 'logic' based upon their strategy for space or use of space for other policy objectives. On the other, experts, agencies, companies and ministries also have their own specific 'logics' to compete with each other to have closer access to decision makers or to convince them if they have preference for particular logic.

The concept of 'policy logics' was proposed because neither 'interests' nor 'beliefs' seem satisfactory analytical tools in order to analyze very complex process of policy-making. Actors in space policy do not consciously differentiate interests from beliefs. Some may believe that space should be associated with national pride and autonomy; others may believe that space should serve for commercial and industrial benefit. Such beliefs and values for space policy are directly reflected on the preferences and interests on the selection of programs or allocation of budget. Experts, agencies, ministries and companies have interest in promoting certain programs in order to reify their belief or values — such as challenging new technology, sending a probe to an unknown planetary body, and so forth. In other words, as Scharpf argues, “people act not only on the basis of objective needs but also on the basis of preferences reflecting their *subjectively defined interests and valuations* and their *normative convictions* of how it is right or good or appropriate to act under the circumstances” (Scharpf, 1997: p.19, emphasis original).

Thus, the concept of 'policy logic' shall be defined as reasoning conducted according to a system of policy principles in which experts, agencies, companies, ministries and decision makers are committed to realize their respective objectives. This study assumes that these actors have their own objectives in policy programs which are to realize their individual values and interests. The 'policy logic analysis' focuses on the logic (and reasoning) of actors for rationalizing their policy objectives and principles. On the one hand, experts, agencies, companies and ministries use their own logic to motivate decision makers to support their objectives and principles if decision makers are not initially in favour of their logic. On the other hand, decision makers have to have their policy logics for rationalizing their decisions and convincing certain groups of experts not to adopt a proposed policy objective.

Types of Policy Logics in Space Policy

There can be many logics or reasoning of actors for rationalizing their policy objectives and principles. But through my previous research, there can be seven different policy logics that drive space policies of states.

Table 1: Policy Logics in Space Policy

Logics	Dominant Actors	Major Values	Perceived Goals
Science	Scientists	Knowledge	Frontier programmes
Technology	Engineers	Evolution	Technological programmes
Commerce	Space Companies	Profit	Improve competitiveness
Security	Military Personnel	Strength	Strengthen capabilities
Autonomy	Decision makers	Independence	Developing full scale capabilities
Infrastructure	Politician and engineers	Utility	Improve economic and social life
Finance	Ministry of finance	Value for money	Budgetary discipline

The first one is the *logic of science.* Scientists, such as astrophysicists, astronomers, geologists and meteorologists, naturally have strong interests and beliefs in scientific programs. As Polanyi (1968) argues, this community of scientists, or 'republic of science', is relatively autonomous to influence scientific development through authoritative decisions. The *logic of science* emphasizes the responsibility of government to support exploration to open the frontier of scientific knowledge for mankind. Actors in this logic regard space as an object of study, and are often influenced by history making achievements of space science such as the American lunar landing or the Hubble Space Telescope. Although the *logic of science* tends to appreciate the universality of its findings and its contribution to the human kind, sometimes the scientific achievement can be translated as the power of the state.

The *logic of technology* is another policy logic which is strongly supported by experts. Engineers who work in the field of aerodynamics, electronics, and propulsion, particularly those who work at the nuts and bolts level, naturally have interests in building state-of-the-art satellites and launchers. Their personal goal of being in space agencies or companies is to develop spacecrafts which are technologically advanced or on cutting the edge of the technological frontier. New inventions or the development of new technologies would bring personal or organizational reward and honor in the space community. The *logic of technology* is also policy logic for decision makers who are concerned with overall national technological development and capability in high technology sector. However, on the assumption that the decision makers' priority is to achieve other political goals by exploiting space technology, decision makers use the *logic of technology* with other policy logics which they put priority on. It is often observed that decision makers show their concerns for technological development as a step toward strengthening international competitiveness of their industry or improving national security. In such cases, the *logic of technology* of decision makers often form a coalition with the *logics of commerce, industry or security*. In certain cases, the *logic of science* needs to form a coalition with the *logic of technology* since it won't be possible to conduct scientific research without new technological development (i.e. sensors to monitor deep space or developing planetary probe spacecraft)

The *logic of commerce* and its variant *logic of industry* are becoming more important these days since the emergence of space ventures and purely private industries. Strong advocates

of these logics are space companies, as well as the user industry, space insurance companies, financiers, and trading companies. For these groups of experts, space is an industrial area where they can make profit, just like other industries. Their behaviour is based on the values of commercial business such as increasing competitiveness, and their interests are simply to make profit from contracts and to win the competition in the market. The *logics of commerce and industry* are attractive to some decision makers.

Because the aerospace industry, which includes the space segment, has been a champion of the defense industry in Europe, and space technology in the United States and Soviet Union was developed by the drive for the military use of space, it is therefore easily assumed that the space sector is developed by the *logic of security (including homeland security).* In many states, ministries of defense (particularly the Air Force) and Chief of Staffs are strong advocates of this logic, but it should be remembered that they are the users of space technology, and that they are very aware that space is not the only means for communication or surveillance. It is rather the decision makers who hold strong the *logic of security* to be important in space policy. For them, it is important to have their own national sources to build their own satellite communication system and to gather intelligence information to make strategic choices.

The fifth policy logic, the *logic of autonomy* and its variant, the *logic of national pride*, overlaps with other policy logics in many cases, but it has certain distinctive features. Its value and long term goal is to secure national autonomy in scientific knowledge, state-of-the-art technology, commercial competitiveness, military control over space assets, and so forth. The distinctive characteristics of these logics are that it is a political goal, but it needs to be used with other logics. There is no particular advocate of this logic among experts, but many decision makers often pursue these logics in their space policy.

The sixth policy logic is the *logic of infrastructure*. This logic has little importance in the analysis of first runner of spacefaring nations such as the United States, Soviet Union/Russia, Europe or Japan. However, in case of China and India, the *logic of infrastructure* sounds very relevant to their policy objectives and rationale for investing in space programs, because of the lack of terrestrial infrastructure. If a country has a huge population size and poor ground infrastructure, it would be reasonable to launch satellites for telecommunications, Earth observation for land use and agriculture, or navigation. It would be much cheaper and quicker to build national strategic network of infrastructure. This logic often associates with the *logic of technology* but it often defies the *logic of finance* because of the necessity for the people. Thus, the advocates of this logic are politician and engineers, as well as user ministries and industry.

Last but not least, the *logic of finance* occupies a unique and important position in the constellation of policy logics. Because of its sheer costs and the unpredictability of technological development, space has been always subjected to financial pressure led by the Ministry of Finance or the Treasury. Unlike other logics, its function is to set a limit of spending for national activities and to put the brakes on the growth of space expenditure. Its value and interest are to sustain the balance sheet of the national budget and to reinforce financial discipline in space policy. The *logic of finance* has been in existence all the time, but its influence is heavily dependent on the preference of decision makers. If decision

makers put priority on space development, the *logic of finance* is overridden by political force, so that space programs are carried on no matter how much governments are in debt. However, a paradigm shift in fiscal policy, often summarized as a shift from 'big government' to 'small government' or 'welfare state' to 'competition state', together with the introduction of a single currency and the so-called 'Washington Consensus' (Serra and Stiglitz, 2008), has shaken up the importance of the *logic of finance* in space policy as well as other policy areas. Decision makers not only became unable to override the legitimacy of the logic of finance, but support and prioritize this logic.

Japanese Policy Logics for Planetary Exploration

The strength of policy logic analysis is that it can analyse the dynamics of the changes of policy logics throughout the time. The space policy evolves through their history and understanding how it has been developed would indicate where it is heading and what sort of historical and institutional constraints that they are under.

Initial Set of Japanese Policy Logics for Space Exploration

Since the beginning of space activities, Japan has been shy from engaging in any security-related use of space. It is largely due to the fact that Japan, with a pacifist Constitution, refrained from using space for security purposes. In 1969, the Diet has adopted a resolution called “Space Development for Exclusively Peaceful Purposes”, which set a limit for Japanese government that any involvement of defence authority for investing in, owning of, and operating space systems. In other words, Japanese space policy excluded the *logic of security* and focused on the *logic of technology*, from the beginning.

Such focus on the *logic of technology* further accelerated by the pressure from the United States. Due to the mounting tension between Japan and the US on the trade issues in 1980s, the Reagan and Bush administrations strongly claimed that Japan was a country with unfair trade, threatening to invoke unilateral sanction against Japan by using enhanced measures to implement the Article 301 of the US Trade Act (so-called “super 301”). The US government criticised that Japanese government protected its industry through opaque public procurement protocols, regulations, and business customs, which made it difficult for the US industry to penetrate Japanese market. The US government threatened to impose retaliatory tariff on Japanese major export items such as automobile and super computer. At the end of the negotiation, Japanese government agreed to conclude an accord for opening the public procurement procedure of non-R&D satellite for international bidders. This agreement, made in 1990, had a very damaging effect on Japanese satellite industry, since its competitiveness was much lower than that of US companies, and in fact, almost all non-R&D satellites were procured from US manufacturers. However, Japanese companies kept calm over this agreement which may have devastating effect on their business, because most of satellite manufacturers in Japan were producers of super computers and electronic goods. It was also them who would have suffered if the US government had imposed sanctions. Putting it simply, they preferred supercomputer over satellites. As a result of this agreement, National Space Development Agency (NASDA, integrated to

JAXA) had to focus on R&D satellite which was the only allowed activity for the government to offer contracts to Japanese industry. In other words, the agreement excluded the *logic of commerce* from Japanese space policy.

Along with the *logic of technology*, the manned space and planetary exploration was considered to be the ultimate goal for Japanese space policy. Since the *logic of security* and the *logic of commerce* were excluded, the power of NASDA in policy making became prominent and its *logic of technology* dominated the discourse of policy making. This has made their way to step up the effort of building manned space flight capabilities through participating the International Space Station project. The development of H-IIB to transport HTV (Japanese unmanned cargo), which aimed to develop reentry capability and to place manned capsule in. The unmanned planetary exploration, on the other hand, was carried out by the Institute of Space and Astronautical Science (ISAS, integrated to JAXA). Their policy logics were based on the *logic of science* which was not regarded as the central policy logic for Japanese space policy. Although ISAS integrated with NASDA to become Japan Aerospace Exploration Agency (JAXA) in 2003, its position in the policy making was still limited to an inferior policy logic to the *logic of technology*. Thus, ISAS was (and still is) unable to fully fund their project which can only be launched once per two years. Since the launching opportunities are limited due to the *logic of finance*, many planetary probes failed as ISAS tried to achieve too many mission objectives with very limited funding. The *logic of finance* and the weakness of the *logic of science* can explain the consecutive failure of PLANET-B (Nozomi, Mars exploration), PLANET-C (Akatsuki, Venus exploration), and near failure of MUSES-C (Hayabusa, sample return mission from Asteroid).

Basic Space Law and Its Consequences for Planetary Exploration

While Japanese space policy has successfully pursued the strategy of "catching up" with other advanced spacefaring nations, Japan suffers number of failures and its self-imposing restrictions. The Diet Resolution of 1969 put Japanese politicians under huge pressure to take proactive measures to identify the threat of missiles from North Korea. In 1998, North Korean missile flew over Japanese territory without intelligence information from its allies. This incident made Japanese politicians aware of the necessity to develop its own imagery intelligence capabilities. However, the Diet Resolution prohibited the Ministry of Defence and Self Defence Force to own and operate any space assets. Thus, the new reconnaissance satellites, Information Gathering Satellites (IGS), was developed and operated by the Office of Information and Research (similar function as the Office of Director of National Intelligence, but in much smaller scale) at the Cabinet Secretariat. The lack of *logic of security* forced to make an awkward decision to place important satellite project in the hands of politically weak organization.

The failure of the launch of second set of IGS in 2005 was also a turning point of Japanese policy logics. When the sixth launch of H-IIA with 2 IGS satellite failed, the Chief Cabinet Secretariat, Yasuo Fukuda, became furious because JAXA explained that H-IIA is an "experimental" launcher for R&D purposes and failure is always anticipated due to the nature of R&D. Takeo Kawamura, then the Minister for Education, Science and Technology believed that the way of thinking in JAXA, based on the *logic of technology*, can no longer be

sustainable in the situation where Japanese technology has accomplished the "catching up" strategy. Thus, he launched a team of reform of the space policy.

Politicians of ruling LDP launched a study group on legal and political issues of Japanese space activities in 2005 and identified the problems of bureaucratically driven space policy. This study group issued a report in 2006 and urged LDP to propose new legislature for regulating space activities by creating a ministerial post with a portfolio of space, establishing a new government forum for space user ministries, and changing the interpretation of 1969 Diet resolution. This report was well accepted by the politicians not only within LDP but also its coalition partner, Komeito, and largest opposition party, Democratic Party of Japan (DPJ). These three parties submitted a draft bill of Basic Law for Space Activities and it passed the Diet by May 2008.

The Basic Law defines the direction of new space policy and new decision-making structure. First, it will set up new Minister for Space and Space Development Strategy Headquarters (Cabinet level decision-making body which includes all ministries using space assets). The Minister for Space would be a "specially designated" minister who will not be in charge of the management of the ministry but to reside in the Cabinet Office for coordinating policies of different ministries. Shifting the power of decision making from the JAXA and the Ministry of Education, Science and Technology to the Cabinet Office certainly demonstrates the shift away from the *logic of technology* and bring other policy logics.

Second, the Basic Law states that "Space development of Japan shall follow the Outer Space Treaty and other international agreements and conducted on the basis of the concept of pacifism in the Constitution" in Article 2. But at the same time, it defines that space development of Japan "shall conduct in order to contribute to International peace and security and national security" in Article 3. This article suggests that traditional interpretation of "exclusively peaceful purpose" as "non-military" would no longer applied. In this regard, the new Basic Law introduced the *logic of security* for the first time in the history of Japanese space development.

Third, the Basic Law put stronger emphasis on the autonomous capability and the importance of the industrial policy. The Article 15 states that "it is important for the State to have the capability to independently develop, launch, track and operate artificial satellites". The Article 16 states that "the State shall, in conducting its own Space Development and Use, consider the procurement of goods and services systematically using the capabilities of private operators" ("Basic Space Law", 2008) and other improvements of industrial competitiveness. These articles suggest that the *logics of autonomy* and *commerce* have been placed in the policy logics of Japanese space policy making.

Finally, the Basic Law has not spelled out clearly about the planetary exploration or manned space program as such. Article 5 and 6 describes that the space programs shall contribute to the development of human society and positively promotes international cooperation, but apart from protection of environment, there was little measures placed to promote science and manned space program. The priority for the *logic of science* is still ragging behind other policy logics.

Thus, Japanese motivation for planetary exploration is driven by the enthusiasm among scientists and engineers in JAXA who promotes exploration programs based on the *logics of*

science and technology, but these policy logics are not in the centre of national space policy making. It can be said that the motivation for planetary exploration is weak, and there is not explicit motivation to compete with other countries.

However, there is one exceptional case for the planetary exploration. "Hayabusa" (MUSES-C), initially designed to be an engineering testing probe for sample return from asteroid, was driven by the engineers and scientists in JAXA. There was a little attention by the general public, because it was largely regarded a project driven by the *logics of science and technology*. Nevertheless, Hayabusa became national icon since it overcame number of difficulties with some dramatic stories. Prof. Kawaguchi, the project manager of Hayabusa and great communicator, provided daily information about the health and whereabouts of Hayabusa. Its success was also a stimulus for national pride since it was the first in the world to conduct sample return from asteroid. For many years, Japanese space programs have never been the "first of mankind" because of the strategy of "catching up". Hayabusa was the first time that Japanese space program has ever achieved something that no one has ever done before.

The public looked the endeavour of Hayabusa as the one that overlaps with the fate of wobbling Japanese economy, and Japanese people found a hope in its success as the success for getting out of the enduring economic struggle. Thus, public demanded strongly to send the follow-on mission to Hayabusa and the decision makers quickly took the opportunity to increase budget for Hayabusa-2 mission. This was a clear-cut case that the *logic of national pride* has pushed the scientific planetary exploration program. However, it was only for Hayabusa-2, and not for other science missions. The basic policy logics for planetary exploration missions remains in the *logic of science* which is not at the top priority in Japanese space policy.

Chinese Policy Logics for Planetary Exploration

Chinese space activities are opaque at best. Even in decision making process of military and civilian programmes, it is not clear which agencies and companies are involved in the programme. When it comes to the military programmes, it is almost impossible to penetrate into decision making community. Because of this opaqueness, there are many analyses of Chinese space policy with a lot of guessing games and speculations. However, it is possible for us to understand the general trend of Chinese space programme and its normative understanding on why China has engaged in the planetary exploration.

Initial Set of Chinese Policy Logics for Space Exploration

In the early days of Chinese space programs, political support mainly came from the *logic of security*, namely the development of nuclear and missile capability (Handberg and Li, 2012). The emergence of China as a space power started in 2000 when Chinese State Council issued the first White Paper on Space Activities. This White Paper was the first public statement on what China aims and achieved in space. It emphasizes on the one hand, utilization of space for peaceful purposes and promotion of the benefit to all mankind, but on the other hand, protection of China's national interests and strength and implementation

of national development strategy.

This dichotomy of global/national ambivalence can be seen in many parts of Chinese strategy for space. On the one hand, China National Space Agency (CNSA) and China Aerospace Science and Technology Corporation (CASTC), both established in 1993, are institutionally under State Administration on Science, Technology and Industry for National Defence (SASTIND)[1)] . These two major organizations are strongly influenced by national political climate and strategic objectives, but they are relatively autonomous institutions from defence community, even though SASTIND aims at developing technologies for national defence. Institutionally, SASTIND is placed within the auspices of the Ministry of Industry and Information Technology (MIIT) and detached from the People's Liberation Army (PLA). It suggests that the *logic of security* has not been strongly represented in the decision-making process through SASTIND. However, from 2008, PLA has its own space wings under the General Armament Department (GAD), which is in charge of managing the procurement and acquisition of weapon systems for the PLA and ensuring defense industry core capabilities. On the other hand, China Academy of Sciences (CAS) and various technological institutions are generally autonomous from national political objectives and tend to emphasize the importance of Chinese contribution to humanity (Aliberti, 2015). According to Besha (2010), who conducted a research on Chinese space policy making through Chang'e-1 case, Chinese decision-making process is ruled by incrementalism, consensus building, scientific judgment and the use of leading small groups to coordinate among ministries.

In the White Paper of 2000, the main objectives of Chinese space programs are stated as "revitalizing the country with science and education and that of sustainable development, as well as in economic construction, national security, science and technology development and social progress" (The Information Office of the State Council, 2000). In this regard, the document shows that Chinese government put equal importance to the *logics of industry, security, science and technology*. However, the strong emphasis was on the application programmes and economic returns. China has not invested extensively on application technology for a long time. Instead, Chinese government sought to acquire application satellites from foreign manufacturers. However, the US export control restriction, known as ITAR (International Traffic in Arms Regulation), put satellite and space technology as controlled items under Munitions List. This meant that export of US-made satellite as well as satellite made with any components and parts produced in the US needs to be approved by the Department of State. Thus, it was imperative for Chinese government to invest in application technology to supply for growing demand for space-based infrastructure and services. In other words, manned space programs and scientific exploration were not the main subject of the policy, even though it was published three years before the first launch of the taikonaut.

Transition of the Policy Logics

The White Papers were published in 2006, 2011 and 2016. Although the key elements have not been changed dramatically, the tone and emphasis of each programs have changed in the course of the deliberation.

The White Paper of 2006 maintained its objectives as “to enhance its economic, scientific, technological and national defense strength, as well as a cohesive force for the unity of the Chinese people, in order to rejuvenate China” (The Information Office of the State Council, 2006). The policy logics have not changed, but it has added the purpose of space activities was to unite Chinese people. This was the time when China faced a serious problem of the division of society between rich and poor, and number of demonstrations took place to criticize the local government. Since China is still a one-party state and the freedom of expression is significantly constrained, the discontent against the government does not appear as it does in the West. However, many protests took a form of expressing their national sentiment, particularly against Japan. The patriot movement to attack diplomatic installations and Japanese-owned commercial facilities heightened in 2005 and onwards. This was partially because of the government instructions to deviate people’s anger towards Chinese government, but also people took the opportunity to express their feelings and frustrations. Thus, it can be said that during this period, the *logic of national pride* for national unity played a significant role.

Therefore, manned space program was ideal way to reinforce that the Chinese Communist Party (CCP) is working hard to bring China up to the level of global superpower and stimulate people’s nationalism for good causes. Manned space flight became the symbol of the greatness of the state and CCP. In this context, the dominant policy logic in the White Paper of 2006 was the *logic of autonomy and national pride*.

The main objectives in the White Paper of 2011 have not changed much. It is stated that “The purposes of China's space industry are: to explore outer space and to enhance understanding of the Earth and the cosmos; to utilize outer space for peaceful purposes, promote human civilization and social progress, and to benefit the whole of mankind; to meet the demands of economic development, scientific and technological development, national security and social progress; and to improve the scientific and cultural knowledge of the Chinese people, protect China's national rights and interests, and build up its national comprehensive strength” (The Information Office of the State Council, 2011). One noticeable difference is that the subject in this sentence is “China’s space industry” rather than “China” alone. It assumes that the space policy is directing towards industry. It also noticed that apart from usual discourse of national security, it emphasized “protect China’s national rights and interests, and build up its national comprehensive strength”. This part suggests that the China, after emerging from the shock of Lehman Brothers which shook the world economy and began claiming the territorial interests in South China Sea. Chinese objectives for space programs are focusing more on the utility for national security and protection of homeland security. It is definitely based on the *logic of homeland security* for this White Paper.

So, for the three White Papers, it is possible to identify the base of policy logic has not changed significantly, namely the *logics of industry, security, science and technology*. But in the course of the evolution of the Chinese space programs as well as the growth of Chinese economic and military power in the world, several new policy logics were added to the base logics. Those are the *logics of autonomy and national pride, and homeland security*. This process of adding new policy logics is often regarded as Chinese ambition in space.

Policy Logics in the White Paper of 2016

The White Paper of 2016 was published in the context of the strengthening Xi Jinping's leadership within the CCP as well as the President of People's Republic of China (PRC). As soon as Xi became the President, he announced his trademark slogan, "Chinese Dream", in the speech at the National Museum of China in November 2012. This slogan aims at the "great renewal" of the Chinese nation by encouraging Chinese nation to work hard to rejuvenate the state ("'Chinese dream'", 2012). Unlike "American Dream" which is more individualistic and competitive, Xi's "Chinese Dream" focuses on the Chinese nation as a whole. In other words, the Xi's administration carries a strong *logic of autonomy and national pride* in the entire policy fields. Space activities, especially manned space program and planetary exploration, are the most symbolic and representative domain of the policy for "Chinese Dream" ("Lunar probe", 2013).

Dream is the keyword in the White Paper of 2016. In its introduction, it is stated that "To explore the vast cosmos, develop the space industry and build China into a space power is a dream we pursue unremittingly" (The Information Office of the State Council, 2016). Also in the "Vision" section, it is stated that "to provide strong support for the realization of the Chinese Dream of the renewal of the Chinese nation, and make positive contributions to human civilization and progress". These sentences indicate that the space is considered as the central piece of Xi Administration's objectives and planetary exploration is understood as the source of China as a space power. The policy priority for planetary exploration has been promoted to the top level not only among the space activities but the entire policy fields.

The major subject in the White Paper of 2016 is not the planetary exploration or manned space program. The main focus is to undertake the development of the space infrastructure for supporting the grand strategy of "One Belt, One Road". This strategy is to establish Chinese presence in various parts of the world and to build terrestrial infrastructure such as railroad and ports to connect Chinese mainland. Asian Infrastructure Investment Bank (AIIB) was established to finance such projects. Through these infrastructure projects, China aims at exercising its influence on the Southeast, South and Central Asia and the Middle East. It also extends its influence on Eastern European and East African regions so that China would have access to natural resources and transportation of Chinese goods to wider markets. Space infrastructures, especially the Beidou satellite navigation system or Chinese GPS and telecommunication satellite networks, are regarded as the key infrastructure to establish autonomous capability to support traffic through the land-based road and maritime-based belt. For Xi Jinping's Administraion, "One Belt, One Road" strategy is the primary objective to realize its "Chinese Dream" and therefore, the space infrastructure became the primary issue among space programs. In other words, the White Paper of 2016 is dominated by the *logic of autonomy*.

Driven by the concept of "Chinese Dream", the White Paper praised the achievement in manned space programs and its lunar probes, Chang'e-2 for high resolution mapping and Chang'e-3 for lunar landing rover. China plans to pursue soft landing and unmanned sample return from the Moon by the end of 2017, and landing on the far side of the Moon by 2018. The objectives for lunar exploration are topographic and geological surveys through

sample return program; radio astronomy observation from the far side of the Moon. As far as its lunar exploration is concerned, the *logic of science* dominates the motivation for these activities in the official document. However, it is too naïve to believe that their policy logic is only limited to the *logic of science*. Even though it has ragged behind the Indian endeavor to send probe to Mars, China is also aiming at sending the first probe to Mars orbit by 2020. Here, the objective of Mars mission is not only orbiting around Mars but also bringing back samples from Mars. Developing technologies of sample return would possibly be applied to the extraction of planetary resources. Since several companies in the United States and Europe are established to commercially extract planetary resources and United States and Luxembourg established laws to regulate planetary exploration, it is safe to assume that China is catching up with such technologies and building its capacity to participate in the commercial race for planetary resource extraction. Thus, it can assume that there is an element of the *logic of commerce* in these explorations. Some even say that Chinese Moon exploration is "primarily strategic, not scientific" (David, 2017), because of the lack of scientific significance of the study of the Moon. However, it would be difficult to assume that the lunar exploration has strategic importance for Chinese security posture or industrial capabilities for defense. The *logic of national pride* may exceed the logics of *science and commerce*, but it would not be convincing that Chinese lunar exploration goes beyond the stated objectives of "Chinese Dream". Since White Paper only deals with civilian programs, it may not be clear how strong the *logic of security* played a role in Chinese policy-making. However, the reorganization of military architecture in 2016 set out the space segment within the "Strategic Support Force" together with cyber units. This suggests that PLA has recognized the importance of space in its process of modernization. It is also noticeable that the Anti-Satellite (ASAT) activities, not only limited to the 2007 campaign but also numerous attempts without using kinetic forces, became important strategic tool for PLA to counter the forces from outside, especially the United States (Weeden and Samson, 2018).

Indian Policy Logics for Planetary Exploration

Indian space has been quite unique compare to other spacefaring nations. It was not initiated or motivated by military competition or pursuit of national prestige or scientific and economic interests. The Indian space policy was strongly driven by the application programme, which would contribute to improve socio-economic condition of India. In other words, India has not been driven by the *logics of security, national pride, science nor commerce*. Instead, its sole driving force was the *logic of infrastructure*, associated with the *logic of technology*.

The Basic Principle Set by the Founding Father of Indian Space

If we discuss the Indian space policy, we cannot avoid mentioning Vikram Sarabhai. He was not only the founder of Indian Space Research Organization (ISRO), but also a father of Indian space activities and spiritual leader of Indian space community. His words for launching ISRO were always cited by Indian space scientists, engineers and policy-makers. Particularly the following passage is often used and cited:

"There are some who question the relevance of space activities in a developing nation. To us, there is no ambiguity of purpose. We do not have the fantasy of competing with the economically advanced nations in the exploration of the moon or the planets or manned space-flight. But we are convinced that if we are to play a meaningful role nationally, and in the community of nations, we must be second to none in the application of advanced technologies to the real problems of man and society." (Quoted in Rao, 2008: p.24),

This statement clearly shows that Indian space is not driven by the *logics of national pride or commerce*. In fact, ISRO and Indian space community have strictly following the idea of Sarabhai, and intensively invested in programmes on telecommunication and Earth observation. Since the first satellite launch in 1979, ISRO has launched two series of satellites, INSAT (Indian National Satellite) for communications and IRS (Indian Remote Sensing Satellite) for Earth observation. In addition to these satellites, Cartosat series for mapping, Resourcesat for agricultural applications, and Edusat for exclusively educational purpose communication were launched.

This record tells that the Indian space activities are exclusively socio-economic purposes or the *logic of infrastructure*, and there is a very little involvement of military authority. Even though skills of Indian engineering are quite high, it is difficult to assume that ISRO aimed to develop state-of-art technology in competition with other countries. Instead, they are motivated to contribute to the socio-economic development of India, and therefore, they are quite dedicated to developing new technology which would be useful for application. In short, Indian space has been extremely application- and user-oriented one.

Emergence of the Logic of Science

Since Indian space activities are mainly focused on application programmes, other space activities, notably space science, were not given the priority. However, this trend has been changing since late 2000s. For the first time, ISRO has been investing in the interplanetary probe to the Moon, Chandrayaan-1, which was launched in 2008. The Chandrayaan-1 mission aimed at high-resolution remote sensing of the moon in visible, near infrared (NIR), low energy X-rays and high-energy X-ray regions.

This programme was proposed in 1999 in Indian Academy of Science and in the Astronautical Society of India in 2000. It was subsequently approved by the government in 2003. It was, on the one hand, a reflection of the confidence of Indian space community. The scientists and engineers realized that they have been successful so far to achieve the initial objective for contributing socio-economic development. India, as a part of BRICs countries, has also achieved high economic growth, even though there are still a large number of people living in poverty. The Indian space community gradually developed its ambition to catch up in other areas of space activities, particularly in space science field. Thus, they found the Moon as the most appropriate target for scientific research. They thought that there are new possibilities of using the moon as a platform for further exploration of the solar system and beyond. It is also expected that the Moon is rich in resources, and India would need those Moon resources for continuing their economic growth while feeding energies to vast population. In addition, all the major spacefaring nations of the world started planning missions to explore the moon and also to utilize moon as a potential base for space

exploration. The *logic of science* together with the *logic of national pride and commerce* emerged as the central policy logic for Indian space policy.

Such emergence of the *logic of science* in association with the *logic of national pride* further demonstrated by the Mangalyaan, or Mars Orbiter, Program. This is the first successful planetary exploration mission by Asian country to enter into Mars orbit. It was launched in November 2013 and arrived in Mars orbit in September 2014. It has transmitted the images and data of Mars surface and atmosphere, which stimulated the pride of space community of India as the fourth successful explorer of Mars after the United States, Soviet Union/Russia and Europe. It is also a great engineering success because India became the first nation to send Mars probe by the first attempt. ISRO is planning to launch the follow-on Moon mission, Chandrayaan-2 in 2019, and Mars mission with more scientific payloads, Mangalyaan-2 by 2020.

For the manned space program, ISRO has proposed manned space program for landing on the Moon several times, mainly in competition with Chinese manned space program. However, the political support for such manned space program has not been strong and ISRO's ambition has not been fully transmitted to the political sphere. The *logic of finance* has been much stronger than the *logic of national pride for manned space* program. However, it is gradually changing. The success of Chandrayaan and Mangalyaan brought Indian confidence in space probe high and the strategic interest for competing with China drew more attention from politicians. In the late 2018, Modi government has given a green light for Gaganyaan manned space program for seven days, which is subject for the approval from the Parliament.

The uniqueness of Indian scientific planetary exploration is that it does not rely heavily on international cooperation. Its technological development is strongly focused on the autonomous technology for the Indian society. From the beginning of the Indian space programs, its objective was to gain the technical skills and capability to build and launch satellites for their people. There was an inherited suspicion for collaboration among scientist and engineers that India may be exploited by the partners, particularly bigger partners. This may, to some extent, come from the historical experience as a British colony and the leader of Non-Alliance Movement. But it is true that India is proud of its success for developing its own space technology without help from other countries, with some exception of early development of PSLV and GSLV launch vehicles. Throughout the history of Indian space development, the *logic of autonomy* has been the unquestionable norm shared among decision makers, scientists and engineers.

Moon Race in Asia?

Some may say that the Indian ambition for developing manned space programme aims to get parity with China. The timing of the Indian proposal for manned-space programme and the Indo-China relationship in the past would suggest that this perspective makes sense. However, if India has an ambition to compete with China, it would have started the manned programme much earlier. It was well known that China has been working on manned space programme from decades ago, and India would have many chances to challenge the pace of

China. However, there was a little discussion among Indian space community that it should move for manned space programme. Also, it would not make much sense because both countries understand the civilian and military capabilities in space, and there is no reason to show off one another. India would be threatened if China develops further military space capability, but not by manned space programme. In other words, unlike the space race between the United States and the Soviet Union during the Cold War, manned space capability does not function as the demonstration of technological capabilities. If India or China wants to demonstrate its military technological capabilities, it would have done in a manner of Chinese ASAT test in 2007. The rule of the game has changed.

It also does not make sense that there is a competition in Asia for racing to the Moon. As we have discussed, the decision made in Japan, China and India for exploring the Moon by Kaguya, Chang'e series and Chandrayaan-1 were taken independently from each other, and in quite different domestic contexts. Japanese probe was supposed to be launched in 2005, which eventually delayed in 2007 due to the failure of launch. Chandrayaan-1 was driven by the changes surrounding Indian space community, notably the economic growth and increasing influence of scientists who were not satisfied with application-oriented space programmes. There may be a possibility that the competition among these three countries in the future, but so far, we have seen continuous Chinese progress in planetary exploration to Moon with five projects from Chang'e-1 to -5, but India has just catching up with planning the second one, Chandrayaan-2, and there is no plan for Japan to launch Moon exploration mission at this moment apart from joining US-led Lunar Gateway program, which is not yet fully supported by the Congress. Thus, it would be misleading to conclude just because three countries launched the lunar probe in the similar timing.

Nevertheless, as discussed above, it would be also misleading that these three countries would choose to collaborate since their objectives are similar. On the face value of the programme, three probes have similar functions, such as mapping of lunar surface, search for mines and minerals etc., but the origin and political purposes are different to each other. For Japan, lunar probe was strongly driven by institutional factors after the integration of NASDA and ISAS to JAXA. Kaguya was a symbol of integration since ISAS scientists provide ideas and purposes whereas NASDA engineers develop suitable spacecraft. For China, its lunar programme as well as manned space programme aim to demonstrate its industrial capability and attract attention of the people as a symbol of nationalism. For India, it was driven by scientists to take the opportunity to increase the share of space science budget and develop dedicated programme for science. In this way, it would be difficult to see Asian countries are competing as the US and Soviet Union did in 1960s, but also difficult to see they share common interest.

Comparison of Policy Logics of Japan, China and India

For understanding the motivations for planetary exploration of Asian countries, namely, Japan, China and India, this article employed the policy logic analysis to find the objectives and rationale for the exploration in the context of wider space policy. The findings are:

- Japanese space exploration, particularly the Moon exploration, was not at the top priority

but driven by the institutional factors. The *logic of science* can only be prioritized when it was associated with the *logic of technology* after the integration of NASDA and ISAS into JAXA. Basic Space Law was a response to the emergence of the *logic of security, commerce and industry,* and therefore, the *logic of science* was hidden behind these logics. The success of "Hayabusa" (MUSES-C) brought the national pride as the first successful robotic sample return from asteroid, but it was not designed to be the project of national pride. The follow-on "Hayabusa-2" was supported by politician and general public for the first time for scientific exploration project. Thus, it can be said that the "Hayabusa-2" is driven by the *logic of national pride*, but none of other planetary exploration project is supported by such policy logic.

- Chinese space exploration has been the central piece of "Chinese Dream" and national unity. Series of success of Chang'e missions to the Moon have been the stimulus for national pride that China is able to achieve what only the United States and the Soviet Union could achieve. The success of landing on the "other side" of the Moon by Chang'e-4 especially stimulated the national pride. Such national pride is more heightened with manned space programs. Especially after the termination of International Space Station in 2024 (or possibly 2028), Chinese space station would be the only manned spacecraft on orbit. This would give a huge leverage for China to provide opportunities to send taikonauts from other countries and use these opportunities to exchange with some material benefit. The central players of planetary exploration are scientists, but politicians took advantage of these scientific and technological progress as the political statement towards outside China. Thus, Chinese space exploration is driven by the *logic of science* and *national pride.*
- Indian space exploration is a new phenomenon in the context of Indian space policy, which has been mainly driven by the *logic of infrastructure.* The idea of Sarabhai has always been the guiding principle of Indian space community. However, since the infrastructure programs have come to satisfactory level, Indian space community sought the next step, which was the planetary exploration. Thus, the Indian programs are largely driven by the *logic of science* advocated by the space community, and the *logic of autonomy* associated with it. Because the idea of Sarabhai was to separate military space from the civilian space community, the space community for planetary exploration is heavily protected from political intervention. Thus, although the *logic of national pride* played some role in the development of planetary exploration programs such as Chandrayaan, Mangalyaan and Gaganyaan, but it is not yet the main driving force for Indian programs.

From these findings, it can be said that the planetary exploration programs in Asia are driven by their own internal policy logics rather than the aspiration of winning the space race. The name of the game for planetary exploration is not who reaches the Moon or Mars orbit first, but to satisfy space community while pursuing different sets of goals based on their national policy logics. Japan is the least enthusiastic for planetary exploration because its policy logics aim at developing commercial, industrial and security capabilities. China is the most enthusiastic party because its policy logics are driven by the *logics of science, technology and national pride*. India is in the middle because the space community demands for challenging exploration missions, but there is a little political enthusiasm.

Note

1） It was previously called Commission of Science, Technology and Industry for National Defence (COSTIND) under the State Council until 2008.

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日本、中国、インドの宇宙政策：比較政策論理分析

宇宙政策は有人宇宙活動には限らない。宇宙開発は科学、技術、安全保障、宇宙ビジネス、国家威信などが動機となって進められ、財政的な制約の中で政治的な選択がなされた結果である。本稿ではかつて筆者が用いた分析枠組みである「政策論理」の概念を用いて日本、中国、インドの宇宙政策にかかわる分析を行い、それらを比較することでアジアにおける宇宙開発競争の現状を理解することを目的としている。日本は長期にわたって「技術の論理」が優勢であったが、2008 年の宇宙基本法によってその政策論理が大きく変化しており、「商業／工業の論理」と「安全保障の論理」が優勢となっている。中国は長らくキャッチアップ戦略を展開してきたが、近年の宇宙探査にかかわる政策は「科学の論理」と「国家威信の論理」が優勢である。インドは「インフラの論理」が優勢であったが、近年は「自律性の論理」が優勢となっている。このように日中印ともに異なる政策論理に基づいた政策を展開しているため、同じゲームのルールで争っているわけではなく、日中印の間に宇宙競争が展開されているとみることは出来ない。

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