

Hybrid Origins of a Modern Vietnamese Science and Technology System: An Introduction to Contemporary History of Science and Technology in Vietnam

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Introduction

At a meeting in Hanoi, the U.S. Secretary of State Mike Pompeo described Vietnam's economic growth as a "miracle" and claimed that the country could serve as a good example for North Korean development.¹ The Vietnamese economy has made impressive strides during the last three decades. However, compared to its economic achievements, scientific and technological competitiveness of Vietnam is not so high. Thus, it may be high time for Vietnamese science and technology (S&T) to take a leap forward based on such economic growth. Although the Vietnamese history of S&T is unnoticed yet, it could be interesting enough for historians of colonial and Cold War science to conduct comparative studies with other developing countries.

The contemporary history of S&T in Vietnam could be traced to the French colonial period in the nineteenth century.² In 1887, French Indochina was established including Cochinchina colony (South Vietnam) and other protectorates, such as Annam (Central Vietnam), Tonkin (North Vietnam), Cambodia, and Laos, where they left the local rulers in power. In 1940, when Germany defeated France during the World War II, Japan took over Indochina. In North Vietnam, the Vietnamese communists (Viet Minh, or League for the Independence of Vietnam, established in 1941) fought against Japanese troops and controlled some parts of this area. In March 1945, the Japanese took over the French administration in Vietnam, established a pro-Japanese government (the Empire of Vietnam led by Tran Trong Kim) and left a power

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¹ David Hutt, "In Nod to North Korea, Pompeo Praises Vietnam," *Asia Times*, July 9, 2018.

² Suggested References for history of Vietnam: Keith Taylor, *A History of Vietnamese* (Cambridge: Cambridge University Press, 2014); Christopher Goscha, *Vietnam: A New History* (New York: Basic Books, 2016); Ben Kiernan, *Viet Nam: A History from Earliest Times to the Present* (New York: Oxford University Press, 2017).

vacuum after they surrendered in August 1945. Ho Chi Minh led the Viet Minh to take over power and declared the establishment of Democratic Republic of Vietnam (DRV) on September 2, 1945. The French determination to return to Vietnam made the communists raise their voice for national liberation. But even when the French finally established the State of Vietnam in 1949, headed by former Emperor Bao Dai (of the Nguyen dynasty), they still refused to return complete independence to Vietnamese despite the efforts of the nationalist Vietnamese. The victory of the Chinese Communists in 1949 and the Korean War in 1950 placed France in the frontline of the Asian Cold War in the fight against communist advancement in the “free world” led by the United States.

During the Cold War, Vietnam was divided into North Vietnam and South Vietnam. In July 1954, the victory of the Vietnamese communists over the French led to the 1954 Geneva Accords that divided Vietnam into two regions at the 17th parallel (the North led by Ho Chi Minh’s communist government and the South led by pro-French non-communist government of Bao Dai). Both Vietnams would reunify following an internationally supervised election in July 1956. Meanwhile in the south, in 1955, with support from the United States, Ngo Dinh Diem, the Prime Minister of the State of Vietnam deposed Bao Dai and proclaimed himself the first president of Republic of Vietnam (RVN). In the two Vietnams, the communist and anti-communist sides focused on taking over the states, consolidating political power, and promoting economic development with their allies. After the ten-year total war, the United States agreed to sign the ceasefire Paris Accords and withdrew from Vietnam in 1973, leaving their South Vietnam ally to fight alone. In 1975, the war ended with a North Vietnamese victory. More than three millions Vietnamese lost their lives during the Vietnam War. Another three millions were forced to leave their home country as refugees. The encounters with French colonialism, Japanese empire, and the Cold War, alongside the Sinitic world impacts, shaped the course of modern Vietnamese history.

Contemporary S&T in Vietnam is the manifestation of its long and rich history. Due to the influences of Chinese civilization and especially Confucianism, in pre-modern Vietnam, Vietnamese respected higher education, favored literature, history, and philosophy.³ They adopted the meritocratic system and recruitment, valued mandarin scholarship with entry examinations, literary studies, and policy questions. Books and manuscripts on S&T were considered less important than those on Confucianism. Thus, there were only a few people who were well educated and had scientific expertise to write books in science, technology, and medicine. These books mainly dealt with knowledge Vietnamese people have accumulated from generation to generation. The documents on science, technology, and medicine in traditional

³ It is expedient to use the term “Vietnam” for the colonial period. During the French colonialism, Vietnam was divided into Tonkin, Annam, and Cochinchina.

Vietnam include a wide range of fields, from medicine and pharmaceuticals, cartography, mathematics, astronomy and calendar to astrology, geomancy, agriculture, handicrafts, technology, and botany.⁴

Confucian and French colonial education followed by the Soviet-model education have left their marks in today's Vietnamese education and culture. Prolonged wars, conflicts, and agriculture-based economy have influenced the development of S&T in Vietnam. Previous works in the modern history of Vietnam have largely sidelined topics related to S&T. Besides, the lack of relevant background documents and statistical data make it difficult to take a more comprehensive approach. As an introductory study, this paper will trace the history of S&T since the colonial period focusing on science education and policy. In particular, the history of S&T in South Vietnam, an ignored topic in the historiography, will be discussed. The coming of *Đổi Mới*, the economic reforms for creating a "socialist-oriented market economy" in the mid-1980s, and the collapse of the Soviet Union in the early 1990s provided more opportunities for the Vietnamese to develop an effective communication channel with world science and engineering. Against the backdrop of new science policies, the number of international organizations that are active in Vietnam has multiplied, which means Vietnamese S&T have seen the process of overcoming colonial, wartime, and Cold War S&T.

Colonial Educational and Scientific Background

During the colonial period, the French arrived in Vietnam with the ideal "civilizing mission." However, this idealistic task was often corrupted by arrogance, racism, and greed.⁵ In 1859, the pre-colonial schools were dismissed in Cochinchina while the ones in Tonkin and Annam were allowed to exist until the early twentieth century. The French administration sought an educational system that produced agricultural laborers and mechanics with basic technical skills and "colonial functionaries for the colonial bureaucracy."⁶ Under French colonial rule, the Vietnamese Latin writing system (Quoc Ngu script) officially replaced Chinese characters in translating official French correspondence.⁷ Besides, to facilitate the colonization of Indochina, the

⁴ Documents related to Vietnamese traditional medicine are dominant in number and evaluated to have the greatest values. The Institute of Sino-Nom Studies in Hanoi has less than 400 books on traditional medicine and pharmaceuticals. For the studies of traditional Vietnamese medicine, see Michele Thompson, *Vietnamese Traditional Medicine: A Social History* (Singapore: National University of Singapore Press, 2015).

⁵ Taylor, *History of Vietnamese* (cit. n. 2), 467.

⁶ Gail P. Kelly, "The Myth of Educational Planning: The Case of the Indochinese University, 1906-1938," in D.H. Kelly ed., *French Colonial Education: Essays on Vietnam and West Africa* (New York: AMS Press, 2000), 27-43.

⁷ Goscha, *Vietnam* (cit. n. 2), 81-82.

French established a limited number of research institutes and experiment stations in Vietnam, especially in agriculture and medicine.

Under the colonial administration, approximately 3% of Vietnam's population reached colonial schools⁸ and the achievements of S&T were absent in the curriculum.⁹ Inspired by the writings of the Japanese scholar Fukuzawa Yukichi (1835-1901), a renovation advocacy movement in Indochina was formed. Soon thereafter, local scholars established free schools, where students learned history, literature, science, and hygiene. Besides, students could seek opportunities for higher education in France, which provided them a more advanced environment than their homeland. Others found ways to study in Japan, the non-colonized Asian country that had won the war against Russia.¹⁰ The case of Japan provided the Vietnamese with the vision that S&T could bring independence (Go East Movement led by Phan Boi Chau). However, French colonizers suppressed these local movements.

The establishment of the University of Indochina in Hanoi marked a turning point in history of modern universities in Indochina. The University was established in 1906 under Governor General of Indochina, Paul Beau, who believed educational infrastructure would contribute to economic development.¹¹ Nevertheless, under political pressure concerning the threat of higher education in the colonies, the university closed in 1908. In 1917, the university reopened after the abolishment of the mandarin exam. One of the reasons for reopening and upgrading the university was the concerns over the political movements of overseas Indochinese students in France. The colonizers wanted to limit the number of students studying overseas by attracting their attention to local schools. Toward that goal, the French colonizers sought to enhance higher education inside the colonies. At this stage, the university functioned as a place for training skilled technicians rather than scholars.

In 1945, a pro-Japanese government introduced a number of education reforms. Quoc Ngu script was made official language of instruction and a dictionary of scientific terms in Vietnamese was compiled. Vietnamese professors had chances to dominate the faculties of the University of Indochina, which was a new turn to Vietnamese education.

⁸ Alexander Woodside, "Problems of Education in the Chinese and Vietnamese Revolutions," *Pacific Affairs* 49:4 (1976), 648-666.

⁹ Christophe Bonneuil, "Crafting and Disciplining the Tropics: Plant Science in the French Colonies," in J. Krige and D. Pestre eds., *Science in the Twentieth Century* (Amsterdam: OPA, 1997), 77-96.

¹⁰ Christopher Goscha, "Asian Origins of Twentieth-Century Military Science in Vietnam (1905-54)," *Journal of Southeast Asian Studies* 34:3 (2003), 535-560.

¹¹ Kelly, "Myth of Educational Planning," 28.

Education, Science and Technology in North Vietnam (1945-1975)

Education and S&T in North Vietnam during this period was strongly influenced by the context of the two Indochina Wars. After the establishment of the Democratic Republic of Vietnam (DRV), the University of Indochina was renamed Hanoi University. Quoc Ngu became the only and compulsory script to all Vietnamese.¹² Since the war fighting against the French broke out in December 1946, the DRV government and supporters moved to the countryside. The DRV operated schools with part-time students, especially in the schools of medicine and foreign languages. General literacy campaign was mobilized among peasants. In 1950, when China (PRC) and the Soviet Union recognized the DRV, Vietnamese students in North Vietnam had opportunities to study in these and other socialist countries.¹³ Besides, the government also operated schools along the border with China, applied the education system and research of the PRC and the USSR with the help of their advisers. Meanwhile, in Hanoi from 1950 to 1954, the French reopened and maintained the French-model system in Hanoi University. In 1954, the division of the nation led to the separation of higher education and scientific communities. Most French faculty members went to South Vietnam to teach in Saigon.¹⁴

In 1954, after the Dien Bien Phu victory, the DRV returned to Hanoi, continued to operate the educational system in the urban areas of North Vietnam. In 1956, the government reorganized Hanoi University.¹⁵ The university curriculum abandoned the French model and followed the curriculum of the Soviet Union.¹⁶ The Soviet model emphasized the educational philosophy focused on becoming “nationalistic, scientific, and popular.” Based on their family backgrounds, students were selected to enroll in the universities. Since many North Vietnamese intellectuals migrated to the South after the division of the nation in 1954, the North lacked specialists in medicine, pharmacy, engineering, etc. Rather than thinking long-term, the government set up crash programs to produce specialists that would temporarily manage the work of the state. As a result, over a period of more than 20 years, the DRV did

¹² President of Provisional Government of the DRV, Decree No.20 (September 8, 1945).

¹³ David G. Marr, “Education, Research, and Information Circulation in Contemporary Vietnam,” in W.S. Turley and M. Selden eds., *Reinventing Vietnamese Socialism: Doi Moi in Comparative Perspective* (London: Westview Press, 1993), 337-358.

¹⁴ David G. Marr, “Tertiary Education, Research, and the Information Sciences,” in D.G. Marr and C.P. White eds., *Postwar Vietnam: Dilemmas in Socialist Development* (Ithaca: Cornell University, Southeast Asia Program Publications, 1988), 15-44.

¹⁵ They set up five universities: Hanoi University of Pedagogy, Hanoi University of Technology, Hanoi University of Agriculture and Forestry, Hanoi General University (Literature and basic Science) and Hanoi University of Medicine.

¹⁶ In the late 1950s, the USSR signed with the DRV many cooperative agreements including Agreement on training Vietnamese overseas students in Soviet educational institutions (1955) and Agreement on Science – Technology Cooperation (1959).

not provide any doctoral program. Students pursued higher education in China, Soviet Union, and other satellite socialist countries.

The post-1945 world affected various approaches to S&T of the DRV. The DRV inherited the French colonial communication system, such as radio station, post-office, telegraphs, telephone, and printing factories for its communicative networks and propaganda campaigns. When the Allies arrived in Vietnam after the capitulation of Japan, the DRV received limited technical aid from the Allies, such as communications equipment and training, as well as radio transceivers that they used during the first Indochina War (1946-1954). Moreover, defeated Japanese officers and soldiers who joined the DRV army in the North and Viet Minh in the South as technicians, officers, and military instructors provided the DRV with an invaluable foreign source for modern military science. The adoption of foreign military knowledge and techniques contributed to the power of the modern Vietnamese national army of DRV. Since 1950, when the PRC and the Soviet Union recognized the DRV, the state received remarkable technical aid from the communist bloc such as radios, telephones, telephone lines, modern artillery, and anti-aircraft weaponry, which enhanced its military strength in the war.¹⁷

The wars strongly influenced S&T in North Vietnam. The first research institute in North Vietnam focused on military S&T for developing weapons to prepare for the war against the French. In 1947, the Department for Technology Research under the Bureau of Military and Weapons was established. Tran Dai Nghia, the engineer who returned to Vietnam after pursuing higher education and working in France and Germany, served as its director.¹⁸ In 1959, the government founded the State Committee for Science to lead and coordinate research. In 1965, the State Committee for Science split into two organs: The State Committee for Science and Technology and the Vietnam Institute of Social Sciences. They were responsible for assisting the government in building and leading the scientific work in all aspects. After five years' planning, the National Center for Scientific Research (NCSR) was established, focusing on basic science, with Soviet assistance in 1975.

In the context of war, research facilities were insufficient and researchers were lacking in quantity and quality. Research institutions operated in a relatively limited manner simply to reduce wartime destruction.¹⁹ Besides, a small-scale agriculture-based economy and Confucianism-influenced society did not provide good opportunities for applied scientists to make use of their expertise. Students and scholars

¹⁷ Christopher Goscha, "Wiring Decolonization: Turning Technology against the Colonizer during the Indochina War, 1945-1954," *Comparative Studies in Society and History* 54:4 (2012), 798-831 on 802.

¹⁸ It was the precursor of the current Military Science and Technology Institute under Ministry of Defense.

¹⁹ See Governmental Committee of the DRV, "Instructions on Direction and Duty of S&T in 1966-1967," No.163-CP (September 1, 1966).

tended to choose pure sciences due to lack of access to available equipment.²⁰ Therefore, S&T activities were limited to basic research and survey, and S&T institutions mainly focused on absorbing transferred technology rather than creative research.

In the military field, technology transfer played a crucial role in the victory of the DRV against Vietnam's technically and militarily superior opponents, France and the United States, in the first and the second Indochina Wars. Exploiting foreign technologies, the Vietnamese learned how to use them effectively to beat against their enemies. The Soviet Union also helped North Vietnam in sustaining the economy, laying the foundations for modern industries such as thermal power, hydro-power, mechanics, chemicals, and building materials. From the mid-1950s to the mid-1970s, the Soviet Union helped build 135 industrial plants and civil works in Vietnam: 46 works for the power sector, 5 works for the mining industry, 19 works for the mechanical engineering and metallurgy, 41 works for the transportation sector, one work for the chemical industry, three works for the building materials sector, and 20 works for the agricultural sector. From 1965 to 1974, the Soviet Union sent more than ten thousand military specialists, from combatants to generals, to help North Vietnam build an air defense force in the war against the United States and South Vietnam.²¹

Education, Science and Technology in South Vietnam (1955-1975)

In South Vietnam, when the Republic of Vietnam (RVN) was established in 1955, the new Vietnamese educational program started to place the leadership in education on the hands of Vietnamese people. Vietnam National University (1955) (then renamed to the University of Saigon in 1957) opened its doors to students who passed the entrance exams.²² Due to a large number of exchange programs, universities in South Vietnam had strong international links with France and the United States.

In terms of culture and thoughts, South Vietnam was more open to new ideas and the outside world.²³ The Constitution of the RVN emphasized freedom in education.

²⁰ Eren Zink, *Science in Vietnam: An Assessment of IFS Grants, Young Scientists, and the Research Environment* (Stockholm: International Foundation for Science, 2009), 13-14.

²¹ Cao Dac Trung, "That is the Vietnam War, 1965-1973" (Chiến tranh Việt Nam là thế đó, 1965-1973), *Military History Journal* 205 (2009), 45.

²² By 1975, South Vietnam had other new universities including Hue University (1957), Catholic University of Da Lat (1958), the Buddhist Van Hanh University (1964), the public University of Can Tho (1966), and the Thu Duc Polytechnic University (1973) which focused more on applied sciences, laboratory work and practical experience in economic and industrial issues.

²³ Taylor, *History of Vietnamese* (cit. n. 2), 611.

The educational philosophy was “humanistic, nationalistic and liberal.”²⁴ Although it lasted for only 20 years (from 1955 to 1975) and was severely affected by the war and frequent political instability, the RVN system educated a number of people with the expertise to contribute to nation building.

During the war, just like North Vietnam, technology transfer played an important role in the building of South Vietnam. The major source of technology for South Vietnam was the United States. The Point Four speech of the U.S. President Harry Truman led to technical assistance programs, through which America shared its know-how to modernize developing nations in the Middle East, Latin America, Asia, and Africa. The South Vietnamese government accepted modern S&T with open arms, and wished to apply the best and most modern technologies to national development projects. President Ngo Dinh Diem admitted: “Today, the country is not self-sufficient. We can say that foreign assistance is a kind of compensation for the services our people have provided to the free world to protect the Southeast Asian market and to fight against manipulations of international communism.”²⁵

Technology transfer for modernization in South Vietnam played an important role in transforming rural societies and the Vietnamese experiences in everyday technology with the presence of new machines, new techniques, and knowledge.²⁶ The United States also brought to South Vietnam hydroelectric dams and other structures that would provide food, water, and power to modernize the nation. The Americans began its technology transfer program in agricultural mechanization in the RVN, as the rural area was generally considered an important front in winning the hearts and minds of the peasants. The RVN imported small machines from the United States for use as water pumps to manage water levels. The tractor was an important item for technology transfer, as well as small household motors, motorized pump, and shrimp-tailed boat engines. American technicians traveled to RVN to help operate portable engines, in order to manage irrigation in the Mekong Delta.²⁷

A notable achievement of S&T in South Vietnam during this period was the Da

²⁴ Vuong Tri Nhan, “Some Thoughts on the Educational Differences between the North and the South of Vietnam” (Mấy cảm nhận về Giáo dục miền Nam và miền Bắc), *Research and Development Journal* 7:8 (2014), 259-267.

²⁵ Nguyen Xuan Hoai, “Republic of Vietnam Regime in South Vietnam (1955-1963)” (Chế độ Việt Nam cộng hòa ở miền Nam Việt Nam giai đoạn 1955-1963), University of Social Sciences and Humanities, Vietnam (2011), 136-139.

²⁶ For the modernization and nation building projects in South Vietnam, see David Biggs, *Quagmire: Nation-building and Nature in the Mekong Delta* (Seattle: University of Washington Press, 2010); James M. Carter, *Inventing Vietnam: The United States and State Building, 1954-1968*, (New York: Cambridge University Press, 2008); Jessica Elkind, *Aid under Fire: Nation Building and the Vietnam War* (Kentucky: University Press of Kentucky, 2016); John Ernst, *Forging a Fateful Alliance: Michigan State University and the Vietnam War* (Michigan: Michigan State University Press, 1998).

²⁷ David Biggs, “Small Machines in the Garden: Everyday Technology and Revolution in the Mekong Delta,” *Modern Asian Studies* 46:1 (2012), 47-70.

Lat Nuclear Research Institute (NRI). In 1953, the U.S. President Dwight D. Eisenhower announced that the United States would share its atomic expertise to serve peaceful pursuits with partner nations. Thus, as part of its technical assistance to the RVN, the United States helped RVN apply its peaceful nuclear program with U.S. financial support, shared its technical knowledge and services, and provided nuclear material. In terms of S&T, the Vietnamese welcomed the Atoms for Peace program in the RVN as a scientific revolution. In 1961, Kaiser Engineers Company constructed the Da Lat NRI. In 1962, General Atomics installed the nuclear research reactor TRIGA-Mark II. The following year, it became the first nuclear research reactor to reach criticality in Southeast Asia. The RVN exploited from its U.S. sponsor to develop its nuclear institution as an incubator to attract and retain scientists and engineers trained abroad, to function as a stepping-stone for future development of science in Vietnam, and to apply the new knowledge toward economic development.²⁸ In the institute, especially during 1964-1968, the scientists conducted research to produce radioisotopes (I-131) used in hospitals or experiments to discover new varieties of crops.²⁹ Nevertheless, the institute could not sustain bigger projects because the destructive war put everything on hold. The Da Lat NRI became a symbol of brain drain in South Vietnam during the war. Only three days after the opening ceremony of the institute, President Diem's assassination during a military coup by a military revolutionary council sanctioned by the United States led to the resignation of the prominent scientist, Buu Hoi, the director general of the institute. Along with the escalation of the Vietnam War since 1965, the scientists of the Da Lat NRI had to struggle for the survival of the program. Most of them were drafted to join military service or found ways to leave the war-torn country. Others, who were sent to train in developed countries, never returned to Vietnam.³⁰ The story related to the Atoms for Peace program in the RVN has fallen into oblivion along with the story of the two American scientists, Wally Hendrickson and John Horan. They received commendations for wartime valor for their mission to retrieve a canister of plutonium from the reactor in the eve of the Communists' South Vietnam takeover in

²⁸ South Korea also tried to promote S&T using the nuclear program as stepping-stone. See Man-yong Moon, "Postcolonial Desire and the Tripartite Alliance in East Asia: The Hybrid Origins of a Modern Scientific and Technological System in South Korea," in Hiromi Mizuno, Aaron S. Moore and John DiMoia eds., *Engineering Asia: Technology, Colonial Development, and the Cold War Order* (London: Bloomsbury, 2018), 173-176.

²⁹ Phạm Trọng Khoi, Letter to S. Yamada, an agronomist of Michigan State University; Le Tuan Anh, Letter to P.A. Morris, Scientific Representatives, US Embassy, Tokyo, Correspondence of the Asian-African-Latin-American branch -Vietnam, January 1964-December 1965, Group 326, Box 2-2, NARA; and Interview with Mr. Nguyen Thuong Khang, former Dalat AERI's scientist.

³⁰ Joseph Treasters, "Enemy Drives Change Dalat From Haven to Nightmare," *New York Times*, Mar 22, 1969. See also Philip Fradkin, "Jobs Abroad: Professional "Brain Drain" Hits Vietnam," *Los Angeles Times*, May 10, 1969.

April 1975.³¹

Recently, Tsuchiya Yuka argued that the Vietnamese nuclear project mainly functioned as a psychological tool rather than a research facility.³² However, Da Lat NRI was expected to work as a stimulus to promote S&T, as South Korean scientists anticipated that the Atomic Energy Research Institute (AERI) would serve as a stepping-stone for the comprehensive development of S&T in Korea. When Vietnam succeeded in reoperating the reactor with Soviet technical aid in the 1980s, the Vietnamese considered this reactor as the hybrid achievement of the United States and USSR.



Figure 1. Da Lat Nuclear Research Institute. Source: Wikimedia Commons.

To sum up, during the Cold War, technology transfer played a crucial role in post-colonial DRV and RVN in the processes of decolonization, nation building, and economic development, especially in the context of the war. Technology transfer is a

³¹ For the interview with Wally Hendrickson, see Hanford History Project, “Interview with Wally Hendrickson” (<http://www.hanfordhistory.com/items/show/70>, accessed in June 2018).

³² Tsuchiya Yuka, “Pyeonghwareul wihan wonjaryeokgwa asiaui miguksan wonjaro hwaksan” 평화를 위한 원자력과 아시아의 미국산 원자로 확산 (Atoms for Peace and Spread of the US Nuclear Reactor in Asia), in Osamu Ota and Heo Eun eds., *Dongasia naengjeonui munhwa* 동아시아 냉전의 문화 (Cold War Culture in East Asia) (Seoul: Somyung Chulpan, 2017), 303-336.

combination of two processes: the influx of foreign assistance and local adaptations and rejections. Local actors sought foreign technology transfer for their own interests. Nevertheless, the development of S&T in Vietnam was modest because the military was at the receiving end of the bulk of the human resources and national budget.

Science and Technology in a Unified Vietnam

After the unification of the nation in 1975, the Vietnamese government unified the educational and research systems of North and South Vietnam. Scientific institutions in Vietnam experienced a process of dissolution, reorganization, and name changes. Most institutions in the South were restructured based on the Soviet model.³³ Those who worked for the former regime were sent to “re-education” camps for political training following Marxist ideology. Besides, the political turmoil in Vietnam in the late 1970s along with the involvement of Vietnamese troops in Cambodia cut off the Vietnamese scholars from the West, while they drifted toward the USSR and its satellite states until 1990.

After years of constant wars and conflicts, in the 1980s, Vietnam’s S&T status was evaluated “50 to 100 years behind that of the most modern countries in the world. Vietnam’s equipment is backward from two to three generations or from four to five generations, depending on each specialized sector, compared with [the] modern level in the world.”³⁴ Since the introduction of *Doi Moi*, S&T policy was diversified and scientific institutions gradually went through significant transformation.³⁵ Especially, the fall of Soviet Union urged the Vietnamese to seek various international cooperation partners. Vietnam today is still in the process of promoting industrialization and modernization, and it has approached the crossroads with changes in policies and practices.

³³ Elizabeth St. George, “Government Policy and Changes to Higher Education in Vietnam, 1986-1998: Education in Transition for Development?” (Ph.D Dissertation, Australian National University, 2003).

³⁴ K. Bezanson, J. Annerstedt, K. Chung, D. Hopper, G. Oldham, and F. Sagast, *Viet Nam at the Crossroads: The Role of Science and Technology* (Ottawa: International Development Research Centre, 1999), 63.

³⁵ For the overview of S&T policy change in Vietnam after *Doi Moi*, see OECD, *Science, Technology and Innovation in Viet Nam* (Paris: OECD and The World Bank, 2014), 23. It divides the history of innovation policy into four periods: ① emergence during economic liberalization (1987-95) ② restructuring of S&T policy frame (1996-2002) ③ global integration reform of state management of S&T capacity building for policy making (2003-10) ④ maturation—toward a fully-fledged and functional innovation system (2011-).

(1) Changes in S&T Structure and Infrastructure

Along with the unification of the nation, S&T institutes in Vietnam underwent reorganization or name changes. In today's Vietnam, research centers and universities along with scientific production concentrates in and around Hanoi, the capital of Vietnam. Ho Chi Minh City (Saigon) is another focus. The reunification led to the dislocation of research institutions' names. There was a duplication of the Northern research structure founded on the remnants of the Southern research infrastructure. Merging and restructuring of research institutions soon followed.³⁶

In 1990, the State Committee for Science and Technology was renamed the State committee for Science and then Ministry of Science, Technology and Environment (1992). Since 2002, it was renamed Ministry of Science and Technology (MOST) and serves as a focal point of the state S&T management. At the national level, the Vietnam Academy of Social Sciences and the Vietnamese Academy of Science and Technology (VAST), the leading national institutes, reported directly to the Prime Minister, alongside National Council for Science and Technology Policy.³⁷ In 2009, the Vietnam Academy of Agricultural Studies was created as a national research center in agricultural development. At the ministerial level, each ministry has research institutes to conduct research and provide policy consultation. At the provincial level, each province has a number of research institutes conducting research for provincial development. The number of non-state organizations in S&T governance remains limited such as the Vietnam Union of Science and Technology Associations (VUSTA) and the Vietnam Intellectual Property Association (VIPA).

The number of S&T organizations has increased in recent years. In 2013, Vietnam had over 1,600 S&T organizations and the number is over 2,500 in 2016. The growth and institutional differentiation of higher education has been remarkable. From 1987 to 2009, the number of students has increased from 133,000 to 1,720,000, and in 2016, this number is 2.2 million. The number of universities has risen from 101 in 1987 to 412 in 2016. In 1987, there were only public universities but the number of private universities grew to 81 in 2009. The proportion of higher education degree holders in the social sciences and humanities is 46.6%, with 31% in S&T, 9.4% in medicine, 7.7% in natural sciences, and 5.3% in agriculture.

Soviet Union's collapse and the opening of the market-oriented economy have led to more interactions with the West. Universities and research institutions in Vietnam could establish and expand their relationships with foreign institutions. A number of

³⁶ Zink, *Science in Vietnam* (cit. n. 20), 17.

³⁷ VAST is the largest and most prominent research institute in Vietnam. It was founded in 1975 as National Center for Scientific Research of Vietnam and renamed National Center for Natural Science and Technology of Vietnam in 1993. In 2008, it became the Vietnam Academy of Science and Technology (VAST). Providing advice and suggestion as requested, the Academy is studying natural sciences and developing technologies based on key orientations by the State.

joint-universities have emerged with the sponsorship of developed countries: The Vietnamese-German University (2008), the University of Science and Technology of Hanoi in partnership with the French government (2009), the Vietnamese Japanese University (2014). There is a plan to establish a Vietnam-Russia University of Technology in Hanoi. These universities are supposed to be “a new model, of high quality with international standards.” In 2016, Fulbright University, the first U.S.-sponsored private, non-profit university in Vietnam, emerged, aiming for an autonomous-model university in Vietnam. In 2016, Vietnam has the first six self-financed public universities.

Nonetheless, Soviet-model research organizational structure and “legacy of a centralized planning management culture” remain predominant in Vietnam.³⁸ Most universities have considered training “vital” and followed the mono-disciplinary model. A research-based university system in Vietnam has just started to emerge. Combination of research with teaching in higher education institutions has increased. Staff members of research institutions are being asked to be affiliated with a university, and to contribute approximately 30% of their time to teaching. Conversely, university professors should carry out research during 30% of their time. In 2014, 16 key universities were identified, including two national (one in Hanoi and the other in Ho Chi Minh City), three regional universities, and 11 normal universities, specializing in various disciplines. They are anticipated to be leading Vietnam’s research in S&T. However, despite policies to enhance research capacity, Vietnamese universities still show low research productivity with low utility.³⁹ Universities receive only 4% of the S&T public expenditure. International donors finance 50% of university R&D with an additional 30% coming from the private sector.⁴⁰ Research is still mainly conducted in controlled and centrally funded research institutes outside universities.

Regarding the role of enterprises in R&D activities, there are only a few enterprises connecting with universities and research institutes in specialized fields to attract and recruit S&T employees and other S&T projects. Recently, big enterprises in Vietnam have paid more attention to R&D activities. In 2010, Vietnam had the first private R&D institute: Binh An Fisheries Research Institute with the objective of maintaining and developing *pangasius* species and other aquatic species of the Mekong Delta by applying new and advanced technology. However, the private sector still has a very small number of R&D centers. According to a survey in 2014,

³⁸ Khanh Van Dao, “Key Challenges in the Reform of Governance, Quality Assurance, and Finance in Vietnamese Higher Education: A Case Study,” *Studies in Higher Education* 40:5 (2014), 745-760.

³⁹ P.D. Hien, “A Comparative Study of Research Capabilities of East Asian Countries and Implications for Vietnam,” *Higher Education* 60:6 (2010), 615-625.

⁴⁰ Tran Ngoc Ca and Nguyen Vo Hung, “Vietnam: Current Debates on the Transformation of Academic Institutions,” in Bo Göransson and Claes Brundenius eds., *Universities in Transition: The Changing Role and Challenges for Academic Institutions* (New York: Springer, 2011), 119-142.

only 6.23% of the 7,450 enterprises conducted R&D. Up to 95% of the small and medium enterprises use backward technology three to four generations old. In short, R&D activity of enterprises is still low and weak.⁴¹

Because of policies in improving S&T activities, the past decades have witnessed an increase in the number of research centers established by corporations to close the gap between S&T and production. New S&T infrastructure appeared such as the Hoa Lac Hi-tech Park (1998) in Hanoi, the Saigon High-technology Park (2002) in Ho Chi Minh City, Da Nang High-technology Park (2010) and 17 Key National Laboratories (2000) to strengthen material and technical bases for S&T and improve the quality of research in the priority areas. Besides, stimulated by Silicon Valley in the United States and Hsinchu Science Park in Taiwan, the Da Nang IT Park, which is under construction, aims to be one of the leading IT clusters in Asia. One of its goals is to attract highly skilled scientists and technicians to work in Vietnam.

V-KIST (Vietnam-Korea Institute of Science and Technology) in Hoa Lac Hi-tech Park has drawn attention of many developing countries. In March 2012, Vietnam president Nguyen Tan Dung visited South Korea and had discussions with KIST researchers on establishing an S&T institute based on the KIST model. During the Korea-Vietnam summit meeting in September 2013, a joint establishment plan of V-KIST was publicly announced. According to the master plan, the Korean government would invest \$35 million to build a research institute with a main building that can house 300 researchers, and to hand over research equipment and knowhow. The Vietnamese government would match that with another \$35 million for setting up the infrastructure and provide a 20-hectare plot of land in Hoa Lac Hi-tech Park. V-KIST will focus on three major disciplines: materials technology, biotechnology for agriculture and medicine, and information technology for the digital industry.⁴² A groundbreaking ceremony of V-KIST took place in March 2018. Vietnam has been the largest recipient of Korea's Official Development Assistance (ODA) and V-KIST is the largest project among Korea's S&T ODA operations. The institute plans to apply an autonomous operation and aims to attract highly skilled scientists and engineers who could work for the domestic industry. Thus, V-KIST is expected to be a driving force for the take-off of Vietnam's S&T, just as KIST was in South Korea.

⁴¹ Dao Thanh Truong, "Current Situation of STI System in Vietnam Enterprises," *Journal of Policy and Management Studies* 31:2 (2015), 33-41.

⁴² Staff writer, "'V-KIST': S. Korea Passing on its 48 Years of Experience, Knowhow to Vietnam," *Business Korea*, March 24, 2014.



Figure 2. Groundbreaking ceremony for V-KIST in March 2018. Source: R.O.K. Presidential House (<https://english1.president.go.kr/President/News/292>).

(2) Changes in S&T Policies

Along with the transition from centrally planned economy to market economy, from agricultural economy to industrial economy in the context of globalization, the government's perception in the role of S&T has shifted through the promulgation and implementation of a system of legal documents and institutional frameworks on S&T. Before 1981, all S&T activities were decided by the state. In 1981, the government allowed to sign contracts in R&D activities that led to the decentralization of S&T activities. At the same time, the government restructured the S&T system and extended the S&T policy framework: the Soviet-style management in S&T activities gradually gave way to a new S&T legal framework. In 1987, the government dismantled the state monopoly on S&T and allowed R&D organizations to establish contractual relationships with individual and private organizations. It was followed by decrees on foreign-technology transfer (1988) signaling the privatization of technology transfer activities. In 1989, the Ordinance on the Protection of Industrial Property Rights set the legal foundation for intellectual property protection. In 1990, the R&D organizations and universities were able to run business and non-state R&D organizations were allowed to emerge since 1992. In 1994, the government approved external grants supporting S&T, which contributed to democratization in

S&T activities.⁴³

The year 1996 witnessed the shift in perception of the communist party in the role of education and S&T since the government adopted the Resolution on “Strategic Orientation for the Development of Science and Technology in Industrialization, Modernization and Mission to 2000.” The government selected IT, biotechnology, new materials, and automation as top-priorities in high-tech to sustain the nation’s development. Its ambitious goal was to apply S&T to achieve rapid industrialization to become an industrialized and modernized country by 2020 through two phases: 1) initially acquire, apply, and capture imported technologies; and 2) create new technologies nationwide. For the first time in the Vietnamese government’s policies, S&T together with education and training were considered top national policies associated with the development of the knowledge economy. The National Institute for Science and Technology Policy and Strategy Studies emerged as a “think-tank” under the Government Office to prepare strategic policies for S&T development.

The government announced that it would increase the S&T budget and made a plan to promote S&T in earnest. The draft of the law on S&T prepared in 1997 stated that the government would earmark at least 2% of the total state budget for S&T development. For preparing the long-term S&T strategy for Vietnam, in 1997, the Vietnamese government asked Canada’s International Development Research Centre to conduct a Science and Technology Policy Review Mission to Vietnam. The mission team tried to draw on its knowledge of other East Asian countries (South Korea, Taiwan, and Singapore) to give specific suggestions for Vietnam. Based on the review,⁴⁴ Vietnam promulgated its Law in Science and Technology to reformulate the ideas of innovation in previous years in 2000.

In 2003, Vietnam launched its “S&T Development Strategy to 2010,” in which it prioritized IT, biotechnology, new materials, automation technology and mechatronics, atomic energy and new forms of energy, space technology, mechanical engineering and machine manufacture, and technologies of preservation and processing of agricultural products and foodstuffs. The government issued a decree on establishing autonomy and self-responsibility of public S&T organizations in 2005. As a result, the administrative misuse of S&T has gradually decreased. At the 10th Communist Party Congress of 2006, the leadership took S&T, along with education and training, as a “top priority,” or “the driving force for socio-economic development, and “was necessary condition to maintain national independence and to successfully build socialism.” The government declared that it would eliminate state control in scientific management and to expand international scientific cooperation, which was considered a key factor in obtaining national development goals.

To promote S&T policy efficiently, processes of reorganization and coordination have enhanced the institutional capacity. MOST’s central role in carrying out S&T

⁴³ Bezanson et al., *Viet Nam at the Crossroads* (cit. n. 34), 40.

⁴⁴ The review was published as Bezanson et al., *Viet Nam at the Crossroads*.

and innovation policy was reinforced with the establishment of supporting organs, such as the National Council for Science and Technology Policy (1992), the Viet Nam Science and Technology Evaluation Centre (2006), the State Agency for Technology Innovation (SATI) (2007), and the National Agency for Technology Entrepreneurship and Commercialization (NATEC) (2011). The Vietnamese government has completed the legal foundation for S&T development with a system of eight specialized laws: Law on Metrology (2011), Intellectual Property Laws (2005), Law on technology transfer (2006), Law on standards and technical regulations (2006), Law on Product and Goods Quality (2007), Law on Atomic Energy (2008), and High Technology Law (2008). The comprehensive legal framework opened up a favorable space for S&T activities and innovation.

S&T Public expenditure has grown from around 0.2% of GDP in 1995 to about 0.5-0.6% in 2012. As of 2013, Vietnam ranks 54th in the world in terms of R&D expenditure.⁴⁵ In 2014, Vietnam S&T Startup Fund was established and operated. The non-profit fund aims to encourage and promote the participation of Vietnamese organizations, citizens, and scientists, who have aspirations, ideas and business start-up plans, to invest in economic development, production and business based on the application of S&T in the production of products and goods for life.

The government has sought to combine the Vietnamese innovation system into the global system and tried to dismantle obstacles between public and private sectors. They emphasized the role of enterprises in contributing to the reinvestment in R&D to improve S&T and preferential treatment of scientific and technological staff, encouraging the application of research results. In 2013, the National Assembly chose May 18th as “Vietnam Science and Technology Day,” which signified the nation’s desire for the development of S&T.

In terms of international cooperation, Vietnam transformed itself from an isolated country in the 1980s to an open nation engaging with more than 70 countries, territories, international organizations and regions in various fields of S&T. Vietnam is a member of more than 100 international and regional S&T organizations; signed and implemented more than 80 agreements and agreements on S&T cooperation at the government and ministerial levels. Nevertheless, though the government’s policies have pointed out S&T development as the foundation and motivation of Vietnam’s development, political stability and sovereignty of the regime is considered the top highest priority, which impedes the democratization in S&T development and decentralization of S&T policy.

⁴⁵ “Vietnam: R&D expenditure” (http://www.theglobaleconomy.com/Vietnam/Research_and_development, accessed in June 2018).

(3) Changes in Human Resources for S&T

After reunification, it was difficult to maintain the links between Vietnamese scholars in the south and their counterparts in the West. During the 1980s, there were only 200 Vietnamese students who studied in the West, while there were an average of 2,400 students sent annually abroad for higher education in socialist countries in Eastern Europe.⁴⁶

Doi Moi policy has emphasized the importance of applied science and downgraded the role of basic research. Without state subsidization, scientists and researchers were confronted with the rapidly changing market economy. While they have become more independent from the state's allocated salaries, it reduces their availability in doing science. Scientists and researchers tend to move from the public sector to private and foreign sectors. Many of them choose to study abroad, after which only a small proportion return to their home country.⁴⁷

After *Doi Moi*, Vietnamese students have more opportunities to seek study abroad in other developed countries. In 2000, to improve the qualities of human resources in S&T, the government approved the project for training scientific and technical staff at foreign institutions with state budget. The project has sent 4,590 Vietnamese (including 2,268 pursuing doctoral degrees), most of whom working in R&D institutions or studying in foreign countries at doctoral and master levels. In 2010, to enhance the qualities of S&T personnel in higher education, the project for "Training lecturers with doctoral degrees for universities and colleges in the 2010-2020 period" was approved. It aims at training 10,000 lecturers in foreign countries for doctoral degrees. In 2015, the government approved a project of training and retraining human resource for S&T with state budget. It is expected that from 2016 to 2025, 350 Vietnamese scientists will be sent abroad to form a team of highly skilled scientists.

Moreover, the number of students who are studying abroad at their own expense or with scholarships from foreign sources are gradually increasing. There was only 23,000 students studying abroad in 2006 while it doubled in 2011 with 48,000. By 2016, the number increased three times with more than 130,000 students studying abroad, of which 90% are self-financed.⁴⁸

Being at the low stage in S&T development, Vietnam faces the problem of lack of technical and human capacity. The total number of researchers in Vietnam (FTE)

⁴⁶ See Zachary Abuza, "The Politics of Educational Diplomacy in Vietnam: Educational Exchanges under *Doi Moi*," *Asian Survey* 36:6 (1996), 618-631.

⁴⁷ Tatjana Bauer, *The Challenge of Knowledge Sharing: Practices of the Vietnamese Science Community in Ho Chi Minh City and the Mekong Delta* (Boon: Development Studies, 2011), 83.

⁴⁸ According to an analysis of Vietnam's Ministry of Education and Training, in 2016, there were 130,000 Vietnamese citizens studying abroad. There were 38,000 in Japan, 28,000 in the US, 11,000 in the UK, 13,000 in China, 31,000 in Australia. There were 5,500 studying abroad with government funds (<https://vnexpress.net/infographics/giao-duc/du-hoc-sinh-viet-nam-dang-hoc-tap-tai-nhung-nuoc-nao-3493240.html>, accessed in April 2018).

in 2013 is 61,663 and the average number of researchers per 10,000 people is 6.8. The number of Ph.D. holders is 8.74%, 18.30% for masters' degree, and 47.39% for bachelors' degree. Considering the increase of the number of students who study abroad, the level of education will steadily rise.

Internal and external brain-drain is another significant issue. Approximately 70% of overseas students have not returned to Vietnam. According to an estimation in 2003, there were 44,236 Vietnamese Ph.D. holders working in the United States as S&T researchers, while there were only 9,863 working in Vietnam, accounting for a particular high brain drain rate of 81.8%. Comparable figures in Thailand is only 29.7%, 10.2% in Indonesia, 14.9% in China, and 43.3% in Malaysia.⁴⁹ Overseas Vietnamese scientists in the United States and Europe have contributed their skills in various fields of S&T, such as computer science, mathematics, aerospace engineering, chemistry, and medical research. They could participate in scientific conferences but rarely joined specific activities in their home countries due to administrative barriers.⁵⁰

Conclusion

The brief survey shows that Vietnam's long-term interactions with China, France, America, and Soviet Union have left impacts in the history of S&T in Vietnam. The Vietnamese encounter with modern science began in the colonial period but the legacy of colonial science did not serve as the foundation for modern science in Vietnam due to the intermittent wars and political instability. During the Vietnam War, the development of S&T was modest, though technology transfer from the superpowers was greatly adapted and contributed to the transformation of Vietnam from post-colonial to modern society. After the war, the Vietnamese succeeded in making a hybrid technology based on the U.S. legacy and USSR's help, such as the reactivation of Da Lat nuclear research reactor. Nonetheless, the prolonged war and the implementation of centrally planned policies made Vietnam lag behind other countries in the area in the 1980s.

In the 1990s, Vietnam rapidly integrated itself into the world and the Vietnamese government started to show their commitment to making S&T the driving force in economic development. The S&T legal framework was set up and the S&T system of personnel and institutions to conduct R&D activities has been formed, along with the emergence of more S&T infrastructure. The Vietnamese government tried to enlarge international relationship to promote S&T.

⁴⁹ Frédéric Docquier and Hillel Rapoport, "Documenting the Brain Drain of « la crème de la crème »: Three Case-studies on International Migration at the Upper Tail of the Education Distribution" (Bar-Ilan University Department of Economics Working Papers, 2009), 7.

⁵⁰ Bauer, *Challenge of Knowledge Sharing* (cit. n. 47), 85.

Examining the trajectory of the growth of S&T in Vietnam, one can recognize the hybrid origins of the S&T system in modern Vietnam, from colonial inheritance to contemporary global cooperation. Generally, S&T system is composed of research institutes, administrative agencies, and other supporting sub-systems.⁵¹ In Vietnam, some research institutes have roots in the colonial period and other types of infrastructure for S&T emerged under unified Vietnam influenced by the communist bloc. With the comprehensive S&T policies, the S&T system in Vietnam has been restructured and become institutionally organized on the strength of broader international exchange of ideas and personnel after the *Doi Moi*.

Recent years have witnessed the changes in S&T development: the penetration of an S&T market, the emergence of business, the increase of S&T international transfer. Despite efforts and changes, Vietnam is still at the crossroad of S&T and innovation development. Its science, technology, and innovation capacity is evaluated as weak and the national innovation system is still nascent and fragmented, while R&D is limited to enterprises and universities. Aside from insufficient investment, the lack of autonomy as a scientific research institute is one of the weakest links of Vietnamese S&T system, which is the legacy of the long-lasting state control and management of S&T. In addition, serious brain drain is another problem for the Vietnamese to tackle. Considering these circumstances, V-KIST could be a clue to solving the problems, as KIST had worked as a catalyst to form a modern scientific and technological system in South Korea. Thus, to have further progress in S&T, Vietnam needs to strengthen its public governance, human resource for the innovation system, as well as enhancing the innovation system in enterprises and improve the contributions of universities and state research institutions.

⁵¹ Moon Manyong, "Understanding Compressed Growth of Science and Technology in South Korea: Focusing on Public Research Institutes," *The Korean Journal for the History of Science* 37:2 (2015), 431-453 on 441-442.

Abstract

As an introductory study, this paper traces the history of science and technology (S&T) in Vietnam since the colonial period focusing on science education and policy. The Vietnamese encounter with modern science began in the colonial period but the legacy of colonial science did not serve as the foundation for modern science in Vietnam due to the intermittent wars and political instability. During the Vietnam War, the development of S&T was modest, though technology transfer from the super-powers contributed to the transformation of Vietnam from post-colonial to modern society. After the war, the Vietnamese succeeded in making hybrid technologies based on the U.S. legacy and USSR's help, such as the reactivation of Da Lat nuclear research reactor. In the 1990s, Vietnam rapidly integrated itself into the world and the Vietnamese government started to show their commitment to making S&T the driving force in economic development. The S&T legal framework was set up and the S&T system of personnel and institutions to conduct R&D activities has been formed, along with the emergence of more S&T infrastructure. Examining the trajectory of the growth of S&T in Vietnam, this paper illuminates the hybrid origins of a modern Vietnamese S&T system from colonial inheritance to contemporary global cooperation.

Keywords: colonial science, Cold War, Da Lat Nuclear Research Institute, V-KIST, science and technology system, *Doi Moi*