DIAKRONIKA
ISSN: 2620-9446
DOI doi.org/10.24036/diakronika/vol24-iss1/415

Bataviaasch Genootschap Van Wetenschappen and the Institutionalization of Science in the Dutch East Indies 1778-1942

Ayi Budi Santosa[1], Abdurakhman Abdurakhman[2], Yeni Kurniawati[1], Wildan Insan Fauzi*[1]
*wildaninsanfauzi@upi.edu
[1]Universitas Pendidikan Indonesia, [2]Universitas Indonesia

Received 19 January 2024
Revised 3 June 2024
Accepted 5 June 2024
pp. 38-50

Abstract
The background of this research is that Science in Indonesia develops through institutions, not ideas, people, or instruments. This research aims to describe the institutionalization of scientific institutions in the Dutch East Indies. The historical method analyzes various resources to aid the reconstruction of the Dutch East Indies's science institutionalization process. This research uses archives from ANRI (National Archives of the Republic of Indonesia) regarding Bataviaasch Genootschap van Wetenschappen (The Batavia Society of Arts and Science). Archives from other scientific institutions, such as Bogor and Cibodas Botanical Gardens, are also used to illustrate the institutionalization process. The findings of this research include studies on the process and the necessity to pay attention to elements such as rules, norms, cultural benefits, roles, and material resources. Institutionalizing science and technology in the Dutch East Indies underwent at least three stages: the emergence of amateur scientists from Europe, the efforts to build scientific groups, and the establishment of science institutions. This research concludes that the first two stages were outside the bureaucratic channels of the colonial government. However, in the third stage, scientists needed help to escape the role of the colonial bureaucracy in developing these scientific institutions. Bataviaasch Genootschap van Wetenschappen, founded in 1778, was a private organization studying commerce, agriculture, and humanities. It played a significant role in encouraging various other research institutions.

Keywords
Bataviaasch Genootschap, Dutch East Indies, Institutionalization, Science and technology, Scientist.

To cite this article
Santosa, A. B., Abdurakhman, A., Kurniawati, Y., Fauzi, W. I. (2024). Bataviaasch Genootschap Van Wetenschappen and the Institutionalization of Science in the Dutch East Indies 1778-1942. *Diakronika*, 24(1), 38-50. http://doi.org/10.24036/diakronika/vol24-iss1/415.

Introduction

The development of science in Indonesia is institution-based, not through ideas, people, or instruments (Adam, 2009). Scientists in the Dutch East Indies measured their success by the usefulness of their research results for the nation and the creation of a robust intellectual community by building solid scientific institutions (Goss, 2014). In 18th Century Batavia, a Dutch intellectual society consisted of some university graduates, many with legal education and lawyers, some academically trained doctors (doctors were surgeons), and most botanists (Groot, 2009). The VOC was seen as playing a half-hearted role in scientific development because scientific practice was only a secondary objective for the company to function. The VOC did not have a blueprint for policy lines related to scientific development. Research funded by the VOC only revolved around research on tropical flora and fauna. In some instances, the VOC even detained and prohibited specific research publications. Scientific activities during the VOC era were mainly directed at producing practical knowledge, namely helpful knowledge that could be applied in the VOC area. The scientific fields that were a priority for the VOC were botany, medicine (surgeons), linguistics, pharmacy, and science related to commercial crops: coffee, indigo, sugar, and others. Colonial-era scientific activities in Indonesia aimed to understand the structure of Indonesian society to make it easier for the colonial government to control politics and economic development (Abdullah, 1964). The sciences that developed during the colonial era consisted of botany, geology, and zoology, later supplemented by studying residents and their customs. This became the basis for realizing and confirming colonial power (Adam, 2009).

Scientific activities in Indonesia began in the 17th century with Jacob Bontius, who studied the flora of Indonesia, and Rompius with his famous work entitled "Herbarium Amboinese". Apart from them was Petrus van der Vorm (1664-1731), pastor and Bible translator renowned for his unsurpassed knowledge of Hebrew and other Eastern languages. Van der Vorm arrived in Batavia in 1688, worked in Ambon for ten years, then in Batavia from 1698. He left an extensive library containing six hundred and fifty books and manuscripts, which was auctioned on August 29, 1731, at his home in Tijgersgracht (Groot, 2009). In Batavia, a Council of Curators and Scholars was created in 1642, along with an educational committee and an inspectorate, but they meant little for the quality of education (Sulistyo-Basuki, 1998). Pastor J.M. Mohr built an observatory there to develop astronomy and meteorology in the Dutch East Indies in 1761 (Kartawinata, 2006). Mohr had contacts with the Hollandsche Maatschappij der Wetenschappen in Haarlem, of which he was a member. Through his wealth, Mohr could devote himself to 'physics and astronomy. Mohr made observations on the so-called transit of Venus in 1761. In 1772, Hollandsche Maatschappij also published Mohr's report on the eruption of Papandayan, a volcano in West Java. Until the end of his life in 1775, Mohr did not appear to attempt to build a particular group of scientists. This was also driven by his views regarding the inadequate climate for science practice and that only a few people in Batavia were interested in science; they were more interested in getting rich quickly. Radermacher, Hooijman, and Von Wurmb, in 1778, continued what Mohr had inherited by establishing the Bataviaasch Genootschap voor Kunsten en Wetenschappen. Radermacher published the second part of his Discourses on the Papandajan Eruption, citing Mohr's report from 1772 (Cœdès, 1913).

European students began arriving in the Dutch East Indies in the 19th century to classify and organize the tropical world of Asia, especially after most of the region fell under colonial rule. They first studied their colleagues' explorations before coming to the colony. This group of scientists created learned societies in the colonies and became amateur researchers before finally being replaced by scientific institutions at the end of the 19th century. They were more interested in studying natural history than observing, describing, and classifying nature. The enormous attention to flora and fauna in tropical regions was caused by several factors, namely: natural history is a scientific discipline that has developed rapidly since the Enlightenment era; Indonesia's natural conditions, which have a tropical climate, are considered rich in diversity of flora and fauna; knowledge of tropical flora would make it easier to imagine the establishment of permanent European settlements in the colonies, and on the other hand, this knowledge was intended for the benefit of the Leiden University botany professor (Soegiarto, 2006). Besides these factors, scientific developments besides medicine and agriculture received little government support. These were done only by amateur associations, which eventually held fewer and fewer meetings and diminished periodic journal publications. Most of their scientific works were only circulated among small circles of European society (Zen, 2006) .

These scientists tried to carry out the social functions and roles of scientists to produce knowledge that is useful for the extensive community. This goal was born from the idealism of these scientists, who

considered themselves the apostles of enlightenment. They tried to create an enlightened society by educating an elite group of intellectuals who would later become the driving force for the progress of the Dutch state and society (Goss, 2014). They believed that the science they developed would change the colonial society and lead them to modernity. In the 19th century, European settlers in the Dutch East Indies thought that the enlightenment-era knowledge of tropical flora would ease them in envisioning the establishment of permanent European settlements in the colony. By investigating aspects of geography, society, and the environment, the Dutch formed a political order appropriate to the colony (Goss, 2014). This was a cultural benefit of science development in the Dutch East Indies colony (Groot, 2009), in his description, has a different opinion. The goals of European intellectuals were less ideal than those described by Goss. There were elements of racism and segregation in the creation of the scientific society in the Dutch East Indies. Forming the Bataviaasch Genootschap intellectual group was one way of fighting against the dominant Indies culture in Batavia for a more transparent European culture.

Recent studies by historians, economists, political experts, and technology experts see that Indonesia is trapped in various obstacles structurally (political, social, political, cultural, and economic) and individually (scientists). Previous researchers should have explored the active efforts of research and technology institutions in overcoming these various obstacles, including in-depth studies of colonial-era research and technology institutions. The articles by (Amir, 2009), (Hill, 1995) discuss the development of science and technology in Indonesia during the New Order period. However, (Amir, 2009) also discuss technological developments until the reform period, primarily until the early 2010s. Meanwhile, (Hill, 1995) and Moon (2020) focus on studies of the New Order period 1966-1998. Aminullah (2007) and (Hill, 1995) revealed political and economic factors as the main aspects hindering the development of science and technology in Indonesia, while Moon (2020) and (Amir, 2009) review social factors inhibiting the development of science and technology. Several research studies have been conducted on Bataviaasch Genootschap, and most of them discuss his works, which focus on the development of science and art (Van Berkel, 2013) . John Bastin and Bea Brommer (1987) describe a brief history of Bataviaasch Genootschap from 1778 to 1867, including its development and works in various fields of science and art. Bloembergen & Eickhoff (2013) and Sonja Boon (2014) discuss the role of Bataviaasch Genootschap in promoting Dutch East Indies colonial imperialism through scientific activities and knowledge development in the area. Anne M. Blackburn (1996), Delrue (2019), and Hans Groot (2009) discuss how the Bataviaasch Genootschap played an essential role in advancing knowledge about natural sciences in the Dutch East Indies in the 19th century through research, specimen collection, and information exchange with scientists from other countries. Meanwhile, Rima Dewi Putri (2021) discusses how Bataviaasch Genootschap was involved in collecting artifacts and natural specimens in the Dutch East Indies and how these artifacts were then exhibited in museums in Europe and North America.

These articles discuss the Bataviaasch Genootschap from various points of view. Still, they do not discuss it in the context of its relationship to the institutionalization of science in the Dutch East Indies. This article reviews the process of institutionalizing science and technology not in the modern Indonesian era but during the Dutch East Indies Colonial government, which began with the emergence of the Bataviaasch Genootschap (Kate, 1907). Studies on the institutionalization process of scientific institutions need to pay attention to elements such as rules, norms, cultural benefits, roles, and material resources (Hessels & Terjesen, 2008). The study of science and technology institutions shows changes and continuity with the birth of research and technology institutions after Indonesia became independent.

Research Methods

This research uses historical methods to analyze the institutionalization process in the Dutch East Indies and its relationship with the Bataviaasch Genootschap. The historical method is a process to critically examine and explore relics of the past (Gottchalk, 1986). In general, historical methods used by historical researchers include heuristics, criticism or verification, aufassung or interpretation, and darstellung or historiography (Sjamsuddin, 2007). At the heuristic stage, researchers visited several libraries and searched archives related to the development of scientists and research and technology institutions during the Dutch East Indies. Libraries at various research and technology institutions (MIPI, LIPI, and BPPT) and Bio Farma provide many sources in the form of documents on the development of various research and technology institutions during the Dutch Colonial government. In the National Archives, documents from Bataviaasch Genootschap, MIPI, LIPI, and BPPT are available, including

various documents issued by the Ministry of Research and Technology. A unique catalog collects and groups archives from the Bataviaasch Genootschap in the national archives.

Developing science and technology in the Dutch East Indies was closely related to Dutch colonial politics. The neerlandocentric aspect that researchers have been unable to avoid is the dominant description of the role of Europeans in institutionalizing science in the 18th and 20th centuries. This is because almost all scientific research and development activities were carried out by the Dutch intellectual elite with European scientific traditions, and there is no evidence of significant contributions from natives (Besari, 2008). However, the critical aspect that this article tries to narrate is an explanation of the existence of elements of colonial political goals in the form of dominating the archipelago behind the process of institutionalizing science.

Result

Science Institutionalization Process in 18th -19th century

Studies on the institutionalization process of scientific institutions need to pay attention to elements such as rules, norms, cultural benefits, roles, and material resources (Hessels & Terjesen. 2008). These elements influence activities and resources to provide stability and meaning to social life. Institutionalizing science and technology in the Dutch East Indies underwent at least three stages: the emergence of amateur scientists from Europe, efforts to build scientific groups, and the establishment of science institutions. The first two stages were outside the bureaucratic channels of the colonial government. However, in the third stage, scientists needed help to escape the role of the colonial bureaucracy in developing these institutions. The institutionalization of scientific expertise pioneered by the quinine flora crats became a pattern for professional biological scientists in the Dutch colonies (Goss, 2014). Goss uses the word floracrat to show the relationship between scientists and the Dutch colonial bureaucracy. Institutionalizing science and technology required an infrastructure supporting the institution's operation. This infrastructure was an organizational system that organized research activities, human resources (workforce) to carry out these activities, an education system, and a system of equipment (Besari, 2008; Honig & Verdoon, 1945). Therefore, Dutch scientists who realized this demanded the colonial government to build quality educational institutions in the Dutch East Indies. Ethical politics accomplished this at the beginning of the 20th century (Besari, 2008).

The Rise of the Amateur Scientist

Huib J. Zuidervaart and Rob H. Van (2004) notes that efforts to develop science began with a European expedition led by Pastor J.M. Mohr in Batavia to observe where Venus stopped when it passed the Sun in 1761. Pastor J.M. Mohr built the observatory with equipment imported from Europe. Mohr re-observed Venus' next stopover in 1769 and guided explorers such as Joseph Banks, James Cook, and Louis-Antoine de Bougainville (Goss, 2014). Mohr believed that scientists should devote themselves to "useful science to raise its status and support it as the most appropriate tool to combat the ignorance and superstition that is so rampant in this country" (Honig & Verdoon, 1945). In 1838, Tijdschrift voor Nederlandsch-Indië (Journal for Citizens of the Dutch Indies) was published as a medium for communicating and exchanging ideas for scientists in the Dutch Indies. Van Hoëvell, a Batavian Protestant pastor, initiated this journal. He believed that the developed knowledge served to build civilization in the colonies. Van Hoëvell developed various scientific disciplines, not only astronomy but also from the philological study of Malay and Javanese literature (Van Hoëvell's field of study) to descriptions of the natural history of the Javanese landscape (Goss, 2014). The Batavian printing press published natural history articles in various genres in the 1840s.

Wolter Robert Baron van Hoëvell (1812-1879) is known as one of the innovators in colonial politics in the Netherlands after 1848. His role as a Member of Parliament (1849-1862) in political debates is considered in all kinds of studies. Van Hoëvell played a role in the most critical developments in society in 1840-1848. His role as a magazine editor, minister, and board member of various private organizations, including Bataviaasch Genootschap, was huge. These functions include things he was involved in, such as press freedom, Hindi language, geography and ethnology, community museums, and state education (Groot, 2009). He delivered a historical treatise on the practice of arts and sciences in the Dutch East Indies at the first general meeting after he had entered the council on June 19, 1839. In this lecture, he also highlighted the cooperation between the Physics Commission and the Bataviaasch Genootschap.

Scientists Build Communities

The community of scholars interested in natural history and other Enlightenment-era disciplines founded the first real scientific community. They held regular meetings, kept numerous journals, and had ongoing research areas. They also had the ambition of holding a famous fair in Batavia in 1853 to demonstrate the achievements of Enlightenment science to the public (Honig & Verdoon, 1945). In 1842, Franz Junghuhn, in De Kopist, encouraged collective efforts to collect various materials and data on the development of natural history in the colonies. In 1843, De Kopist changed its name to Indische Magazijn (Dutch Indies Magazine). These collective efforts to develop science indirectly required a science institution to organize these efforts. They hoped that their scientific organizations and research publications would become the colonies' first civil society institutions (Gottchalk, 1986). Efforts to expand the reach of knowledge and broader participation had failed. It did not reach the Javanese elite or even Indo-Europeans. Dutch intellectuals in Batavia were far from the rest of Batavia's urban community and needed more interaction with other Javanese residents.

In 1848, Van Hoëvell tried to expand his coalition by including Indo-European groups in the colonies, but senior scientists rejected this. In May 1848, van Hoëvell held a meeting attended by five to six hundred citizens of the Dutch East Indies. This meeting discussed the possibility of colonists born in the Dutch East Indies who had been born in the government sector having greater access to job vacancies in the government sector by expanding educational opportunities in Batavia (Honig & Verdoon, 1945). In 1848, Van Hoevel held a meeting in Batavia to institutionalize science in the Dutch East Indies. It gave birth to the importance of research in geography, society, and the environment to help build political order in colonial countries. A follow-up to the meeting was an exhibition of naturalist research results held in 1853 in Batavia. The trigger for holding the 1853 exhibition was the Great Exhibition in London 1851. Natuurkundinge Vereeniging designed the exhibition in Nedelandsch Indie. The group was led by Piet Bleeker, Junghuhn's best friend, who had succeeded in keeping a journal on natural history since the 1840s. The 1853 exhibition was designed as an exhibition of famous and industrial works of art from the Dutch East Indies. The organizers, colonial government officials from Europe who came to Batavia in the 1830s and 1840s, believed that a comprehensive exhibition of the colony's natural resources would increase the community's industrial and agricultural production.

Since its founding in 1850, the Natuurkundige Vereeniging in Nederlandsch Indië (Netherlands Indies Naturalists Association) has continued to look for ways to institutionalize the various achievements of the Enlightenment era during the 1840s. The Naturalist Association was the brainchild of one of Junghuhn's old friends in the colony named Piet Bleeker. He was a military doctor and amateur naturalist. The Naturalist Association proliferated outside Bataviaasch Genootschap. Early copies of the journal were sent to all members of the Bataviaasch Genootschap. Even though the Archipelago had not been of concern to naturalists for more than 50 years, the Naturalist Association and its journal became the first institution dedicated to natural research. They were founded on the initiative of the local community (Goss, 2014). Bleeker notes that scientific development was far behind Europe's when he left the Dutch East Indies in 1860 (Soerohaldoko & dkk, 2006).(Goss, 2014) assesses that this decline occurred since the 1850s due to several factors: First, their various enlightenment initiatives differed from the popular movement; Second, most were government employees. Scientists from Van Hoëvell to Bleeker came from Europe in the 1830s and 1840s to work for colonial governments. Third, there was no broad social support because their scientific activities were limited to Batavia. Weitzel believed that the lack of scientific progress in the colonies was because they were filled only with Europeans, and their stay was temporary, primarily because the Europeans merely aimed to make a fortune. Significant colony changes would occur if there were any independent political and intellectual life.

Nevertheless, efforts to develop science continued. Alfred Wallace (1854-1862) followed Alexander von Humboldt's pattern to analyze the geographic distribution patterns of flora and fauna and traveled throughout the archipelago (Honig & Verdoon, 1945). In 1857, the liberals appointed a Dutch scientist, a botanist named W.H. de Vriese, to ascertain agricultural conditions in the Dutch East Indies and traveled throughout the colony demanding the best answer to the question of how to free the export economy from government monopoly (Soerohaldoko et al., 2006). De Vriese advocated that any changes in the colonial agricultural system should be designed based on scientific foundations (Honig & Verdoon, 1945). The Dutch government assessed that the Natural Sciences Commission's natural history research could not increase economic profits from the agricultural and plantation sectors. King Willem II advocated disbanding the Natural Science Commission in 1844 (Purwantoro, 2000). The demand to

immediately bring economic benefits from scientists' studies made the Utrecht chemist G.J. Mulder 1850 propose to the government to properly acclimate selected plant types. In the mid-19th century, Sir Clements Markham began an effort to acclimate quinine. Markham played an essential role in efforts to disseminate the argument that there was a relationship of dependency between science and the empire as the 20th century approached. Scientific developments other than medicine and agriculture received little government support. These were done only by amateur associations, which held fewer and fewer meetings and diminished periodic journal publications. Most of the results of their scientific works were only circulated among small circles of European society (Goss, 2014; Groot, 2009).

Early Attempts at Institutionalization

The institutionalization of science was closely related to the relationship between scientists and colonial countries. In the period 1850-1860, significant changes were seen. Changes to the colonial bureaucracy provided opportunities for scientists to access power for further scientific development. Colonial officials in Buitenzorg appreciated the ability of scientists to research tropical natural resources on condition that this matter was kept away from politics. The trigger for the institutionalization of science in the colony began in the early 1840s when the governor general gained control of the Buitenzorg Botanical Gardens. Thus, this relationship built a pattern of attachment between scientists and the state, where scientists were exploited in specific ways for the economic interests of the colonial state. This is what Goss calls flora craft (Goss, 2014).

This kind of relationship between the state and scientists differed from the pattern in Europe, which shows the independence of scientists. In the Dutch East Indies, the state utilized the expertise of scientists. It became a patron for scientists by encouraging them to produce economically profitable things and for scientists to gain access to facilities and funds to support their research. The state began to create science projects, one of which was Governor General Rochussen employing Junghuhn outside the central colonial science authority, the Natural Sciences Commission, to conduct surveys in Southwest Java. Minister of Colonial Affairs P. Mijer even warned the ambitious chemist J.E. de Vrij in the Dutch East Indies so that scientists would obey the political hierarchy. Such a pattern is visible in Pahud's relationship with Junghuhn. Pahud's relationship with Junghuhn symbolized the vision of science utilization for the colonial state. Moreover, Junghuhn joyfully played his role (Purwantoro, 2000). Pahud gave Junghuhn a position as an inspector of Dutch East Indies scientific research and gave him great power, autonomy, and funds, not only for the acclimatization of cinchona trees but also for directing all science in the colony (Soerohaldoko & dkk, 2006).

Scientists could use these patron relationships in scientific development aspects but not political elements. J.A.A. van Doorn argued that technocrats needed to realize the potential of their political power so they did not exploit it. This can be seen in the attitude of the colonial government, which ignored input from Junghuhn, Blecker, and De Vriese, who asked that scientists be given space to direct colonial policy. The project that brought together the interests of the state and scientists was the quinine acclimatization project of 1854. The colonial state supported plant acclimatization research and scientific education to a lesser extent, including medical and agricultural schools. During Fransen van de Putte's time in 1860, science was under the strict control of the bureaucracy (Goss, 2014). In 1866, the Buitenzorg Botanical Gardens were supervised by a new department, the Department of Education, Religion and Industry. The colonial government did not let colonial science find its way, and even then, colonial scientists had to be taught how to do their work. Thus, science would only become one part of the colonial bureaucracy. Due to this pattern of patronage, scientists had to prove their quality against colonial capitalism by creating economically beneficial knowledge (Besari, 2008). The institutionalization of science began with the Bataviaasch Genootschap der Konsten en Wetenschappen. The cultural institutions of the 18th-century Enlightenment had been neglected since the 1790s but were revived in the mid-1830s. The publication strengthened its position as a major scientific institution in the 1840s. This publication was the third publication in the colony. In the 1840s, 11 different types of journals were published in Batavia, and almost all were published by Bataviaasch Genootschap. For example, De Kopist, founded in 1842, began reprinting important articles from various European journals and newspapers (Goss, 2014; Groot, 2009). The first scientific institution was the botanical garden around the governor-general's palace at Buitenzorg. This botanical garden was initially used as a laboratory for the Natural Sciences Commission. However, in the 1840s, its management was again under the control of the governor-general (Goss, 2014; Soerohaldoko & dkk, 2006). After the 1870s, scientific institutions

specializing in economic botany were founded because they realized the importance of agricultural commodity exports (Goss, 2014).

The power of scientists began to expand when Melchior Treub, in the first decade of the 20th century, created a powerful new institution: the Ministry of Agriculture. Treub convinced other officials that scientists should have power and authority in leading the agricultural life of the colonial state (Nijmeeggch Dagblad, 1959). Treub made the ministry and its researchers a forum for modern economic reform by creating mechanisms to disseminate knowledge to native circles, even though these efforts failed (Soerohaldoko & dkk, 2006). Treub continued to work to place scientists in the leadership of colonial governments. This position must be supported by research results that could convince the government of its economic benefits. In addition, this effort required the support of other scientists since the political position of scientists required collective work (Arnhemsche Courant, 1959). Treub had to show concrete evidence of his ability to subdue the tropical world under the will of the Dutch colonial government. K.W. Dammerman, head of the botanical garden and chairman of the Natuurwetenschappelijke Raad at that time, warned the government of the possible breakdown of the old agreement between science and the state (*Het Nieuws van Den Dag Voor Nederlandsch-Indië*, 1932). Treub's entry into the colonial bureaucracy was inseparable from his success in turning the Bogor Botanical Gardens into a prestigious scientific institution at both national and international levels. Treub continued to work on developing these research stations, such as the Museum of Zoology and Plant Pathology, which was founded in 1894. Treub was also adept at gathering private support for his new institutions, such as zoological museums, from within the botanical garden family. The Dutch East Indies Agricultural Company and the Dutch East Indies Commercial Bank initially underwrote the maintenance of the zoological museum, including the first four years' salary of its head, J.C. Koningsberger.

Discussion

The importance of science in Indonesia has been felt since the Dutch colonial era. Based on these interests, at the end of the 18th century, J.C. Rademacher founded the so-called Bataviaasch Genootschap voor Kunsten en Wetenschappen. Radermacher became board chairman and was joined by ten board members (steering members). In the Program, it was said that the members were elected by themselves and among themselves. In 1778, there were 104 members of this association. Some of the administrators of the Bataviaasch Genootschap were Jacob de Meyer (Member of the judiciary and lawyer), Josua van Iperen (Priest), Johannes Hooijman (Priest), Sirardus Bartlo (Member of the council), Willem van Hogendorp (Trader), Hendrik Laclé (Merchant), Jacobus van der Steege (Doctor), Egbert Blomhert (Notary), Paulus Gevers (Merchant), and Frederik baron von Wurmb (Merchant) (ANRI, 1978-1979). Members from indigenous circles had just recorded in 1826. On October 5, 1778, during the fourth council meeting since June 1 that year, the society's medallion stamp was decided to be made by the Amsterdam coin maker J.G. Holtzhey, which could then be used to score gold and silver medals in Batavia. The founding date was included in the stamp design. In the first decade of its existence, this society attempted to revive Mohr's astronomy, although it could have been more successful (ANRI, 1778-1779). Bataviaasch Genootschap was founded in Batavia in 1778 and existed until 1962 when it was disbanded by handing over the museum building and its collections to the Indonesian government (Groot, 2009). This association aimed to stimulate and disseminate knowledge.

Bataviaasch Genootschap was inspired by the Hollandsche Society of Sciences, founded by the Haarlem Elite. The group seeks to promote science in Dutch society. Hollandsche Maatschappij der Wetenschappen was mainly devoted to pursuing natural sciences, medical sciences, and natural history while promoting agriculture (Beer, 2014). The Haarlem group consisted of leading scientists in the Netherlands; its members included university professors, independent scientists, and amateurs, and its founding was modeled on similar groups founded in Paris (the Académie des Sciences in 1666) and London. Prince Willem V served as the protector of the organization. This organization built a pattern where scientists promoted science under the auspices of wealthy people. In the end, the pattern was followed by others (Beer, 2014; Groot, 2009). Apart from the Hollandsche Maatschappij der Wetenschappen, other scientific groups that existed in the Netherlands in the 18th century included the Zeeuwsch Genootschap der Wetenschappen, the Batavia Society of Experimental Philosophy (*Rotterdamse Courant*, 1786) and the Provincial Utrechtsch Genootschap (1778). The Netherlands officially had a science institute under state auspices when Louis Napoleon founded the Royal Institute of Sciences, Literature, and Fine Arts in 1808, which played a significant role.

Radermacher (1741-1783) had an essential position in the civil service in Batavia and succeeded in building that position through his relations in the Republic and his marriage (Het nieuws van den dag voor Nederlandsch-Indië, 1928). Radermacher, in 1764, was appointed grand secretary at a meeting of the Dutch Masonic Lodge in The Hague. Radermacher followed his father's involvement in Freemasonry. He came from a family of regents that was influential, ambitious, wealthy, and active in Freemasonry. He was included in the ranks of the Batavia government after being appointed to the council. He was interested in science, had a library in Batavia, and collected physics instruments. He also collected rare objects used in the 18th century, such as Javanese musical instruments (Groot, 2009). At the end of 1778, the Batavian government wrote to VOC bureaucrats in offices in remote areas to request their cooperation in several matters concerning natural history (Het nieuws van den dag voor Nederlandsch-Indië, 1928). This pattern of using colonial bureaucrats also occurred later in the 19th century. The government - sometimes encouraged by the government in The Hague or institutions in the Kingdom - directly appealed to its civil servants to devote themselves to Indonesian linguistics, geography, and ethnology. The association organized scientific competitions among members and non-members. Still, it was limited to European communities, and on May 10, 1779, Radermacher, Hooijman, and Von Wurmb inspected the gardens of former Johannes Wasmuth (not a member) and David du Fau de la Longue (member) in the Batavian highlands, where they succeeded in growing pepper and cocoa. Both received silver medals as encouragement (Groot, 2009).

In 1779, Bataviaasch Genootschap opened its library and other collections to the public in Radermacher's house by the Grote River. By February 1780, their opening time had been extended to three hours, with Palm's sexton assigned to supervise the library. The premises remained in use until 1814. Funding for the organization came from its members. The main benefactors in the early years were Chairman Radermacher himself and his colleague on the Board, David Joan Smith. Radermacher was a wealthy collector and generous patron of the arts. Every year, the library continues to add to its collection of books, catalogs, and various things related to natural history, archeology, and history (Rotterdamse Courant, 1786). After Radermacher, Adriaan Moens (1783-1792) and Jan Hendrik Wiegerman (1792-1799) held the association's leadership. After Wiegerman died in 1799, on March 31, 1800, the seven remaining council members reunited for the first time in many years. They were Frederik Schouwman (council member since 1784), Andries Teisseire (1789), Jeremias Schill (1790), Johan Theodorus Ross (1790), Carel van Naerssen (1791), Albertus Henricus Wiese (1794) and Willem Michaël Döckers (1794). When the prominent supporters of the Bataviaasch Genootschap der Konsten en Wetenschappen died or left Indonesia, and changes occurred in the colonial government with little interest in the Enlightenment, the organization disbanded in 1789. The long-term institutionalization of the Enlightenment required more than personal interest or patronage (Goss, 2014). Raffles was recorded as the person who breathed new life into the Bataviaasch Genootschap and became the second significant figure in the history of society after Radermacher. Another important event during Raffles' presidency was the inauguration on August 24, 1814, of the new community premises at Weltevreden (Sociëteit De Harmonie). Raffles meant a lot to Bataviaasch Genootschap: revival, reorganization, new members, resumption of Verhandelen publishing (after 20 years of silence), access to a printing press, new building, inspired and programmatic contributions to meetings and publications, and contacts with British researchers (Groot, 2009). Raffles involved cartographers and historians such as Colin Mackenzie in collecting data about Java, including historical-archaeological material. Lieutenant Colonel Colin Mackenzie (1754-1821) was a new member of the Bataviaasch Genootschap who entered in 1812. He was a land surveyor and cartographer and had a historical-archaeological collection. He seemed suitable for the expedition to Java precisely because of his cartographic skills. Raffles' involvement in the Bataviaasch Genootschap is also proven by the fact that he pioneered the Java Auxiliary Bible Society, mobilized community life - supported by a woman who brought European elegance back to Batavia - and founded the Java Benevolent Institution (ANRI, 1783).

Van der Capellen, in October 1816, took over leadership of the Javaasch Medewerke Bible Society, becoming a patron of the Javaasch Menschlievend Genootschap, founded by Raffles, which fought the slave trade (Rengers, 1947). The Bible Society and Menschlovend Genootschap had more members than the Batavia Society. Philippus Wedding became chairman of the association in 1916. Philippus Wedding arrived in Batavia in 1810 to work as a priest among Catholics. After the Wedding, the group was led by Jan Van der Vinne. Jan van der Vinne (born in Amsterdam 1793) was one of the

civil servants who arrived in Batavia in September 1816. In 1817, he became the secretary of the Directorate of Agriculture, Arts, and Sciences and thus worked for Reinwardt.

In 1822, the Bataviaasch Genootschap became an advisory body to the government. The government decision dated July 24, 1823, in which residents were tasked with caring for Javanese antiques, resulted from the committee's work. Bataviaasch Genootschap was secondary in sending dried and live plants to institutions in the country of origin, usually university botanical gardens in the Netherlands. Bataviaasch Genootschap's closeness to the government is further emphasized by the fact that donations from members outside Batavia could be collected by depositing them into the state treasury through the population office. Since the eighteenth century, Bataviaasch Genootschap has had an extensive network of relations with members in Java at branch offices in Asia and with associated members in Europe. There were close communications with scientific institutions in Amsterdam, Brussels, Middelburg, Groningen, Malacca, and The Hague from 1817 to 1820. In Maurisse's report to the general meeting of 1823, he mentioned those among the institutions and people who had donated books to public libraries were the Ministry of General Education, National Industry and Colonies, the Royal Institute (Amsterdam), the Chancellor and Senate of the University of Groningen, the Zeeuwsch Genootschap der Wetenschappen, Natural, and Chemical Society (Groningen), Utrecht Society, Hollandsche Maatschappij der Wetenschappen (Haarlem), former lieutenant governor Raffles, American Philosophical Society (Philadelphia), W. Milne (Malacca) and Blume (Buitenzorg).

Van der Capellen's departure meant that Bataviaasch Genootschap lost an active patron. Lieutenant Governor General HM de Kock replaced his position. De Kock attended the meeting on January 5, 1826, and then introduced J. van den Bosch as an honorary member, who later became governor-general and minister of the colonies. In the Du Bus government, maintenance of buildings on Rijswijkstraat and printing payments to Landsdrukkerij were charged back to Bataviaasch Genootschap, and it seemed that the government was starting to look away. As chairman of the Bataviaasch Genootschap, Strib Bousquet honored Du Bus by making him the association's patron. During these years, the society could rely on two essential council members: acting chairman Lenting and secretary Van der Vinne, as well as members who were very active in writing, namely Hendrik Jacob Domis (1782-1842) and Philipp Franz von Siebold (1796-1866). Domis had also been a member of the Royal Asiatic Society. Philipp Franz von Siebold was a doctor who arrived in Batavia in February 1823. The most famous scholar and writer who ever became a member of the society was undoubtedly Johann Wolfgang von Goethe. Father Diederik (Dirk) Lenting (1789-1877) and engineer Jan van der Vinne (born 1793) were the two most important members of the council in 1822-1834.

There were about 80 members from 1816 to 1821, most of whom were members by name only, as dues were not collected, and there were almost no meetings. After the departure of Van der Vinne and Lenting (1834), the number of members fell from 281 (in 1834) to 248 (in 1835). However, under chairman Peter Merkus, the necessary efforts were made again. At its first general meeting, on April 9, 1835, 33 new members were nominated. In 1836, the number reached 266. In 1835, the colonial government decided to build a natural history museum in Batavia. In August 1835, the government still needed clarification about establishing a museum of natural history, language, society, and archeology (formulation Bataviaasch Genootschap) or a museum of natural history, antiquities, rare items, etc. (government formulation). Bataviaasch Genootschap continued to obtain rare and antique items confiscated by the Colonial Government from several conquered Sultanates. In November 1834, the Bataviaasch Genootschap was allowed to choose from what remained of the Banten sultan's possessions. In June 1835, the government handed over the sultan's and the Tidore sultan's manuscripts to the Bataviaasch Genootschap. In January 1836, the government offered to take over the archaeological jewelry. The jewelry had been unearthed by a Javanese near Pacitan (ANRI, 1869-1870).

In its development, Bataviaasch Genootschap focused more on socio-cultural, historical, and archeological studies. This encouraged members of the Bataviaasch Genootschap to establish several organizations that oversee the study of natural sciences, such as the Dutch East Indies Physics Commission and Natuurkundige Vereeniging in Nederlandsch Indië (Netherlands Indies Naturalists Association). Since its founding in 1850, the society continued seeking ways to institutionalize the achievements of the Enlightenment during the 1840s. Natuurkundige Vereeniging in Nederlandsch Indië was the idea of one of Junghuhn's old friends in the colony named Piet Bleeker. He was a military doctor, amateur naturalist, and Junghuhn's best friend since the 1840s. Natuurkundige Vereeniging in Nederlandsch Indië and its journal became the first institution dedicated to natural research (Goss, 2014).

Apart from several of its members establishing other scientific institutions, the existence of Bataviaasch Genootschap triggered the birth of various scientific institutions, including the Bogor Botanical Gardens. The contribution of the Bogor Botanical Gardens to the development of science in Indonesia has been very significant since its inauguration on May 18 1817. Dr. G.G.C. Reinwardt was born in Germany on June 3, 1773. He worked as a biologist and health expert and was a pioneer in the construction of the Bogor Botanical Gardens (Koswara, 2006). Apart from the Bogor Botanical Gardens, the Dutch East Indies Physics Commission was formed in 1820. The research assigned to Reinwardt was given a permanent character by establishing the Physics Commission. The Physics Committee greatly encouraged natural research in the Dutch East Indies (Sudarijanto, 1992). At the end of the 19th century, the Dutch scientist Melchior Treub continued to develop scientific institutions by forming the Commissie tot Bevordering van het Natuurkundig Onderzoek der Nederlandsche Kolionën (Commission for the Advancement of Physical Research in the Dutch Colonies). Upon returning to Buitenzorg, he founded a sister organization, the Indische Comité van Wetenschappelijk Onderzoek (Netherland Indies Scientific Research Committee) (Koswara, 2006).

Onderwijs van Inlandsche élèves voor de geneeskunde en vaccine (Bumiputra medical school) was founded by Dr. Willem Bosch (Head of the Dutch East Indies (Imron et al., 2021) Government Health Service) on January 1, 1851. The first veterinary college in the Netherlands was opened in 1821 by R.A. Coppicters. In 1888, the Research Laboratory for Pathological Anatomy and Bacteriology (Research Laboratory for Pathological Anatomy and Bacteriology) was established at the Military Hospital in Weltevreden, Batavia (Jakarta) with Christiaan Eijkman (August 11 1858 to November 5 1930) as director. In 1896, the Pasteur Institute was founded in Batavia. The Pasteur Institute and the Smallpox Vaccine Manufacturing Center were dual and under one leadership by a director starting in 1896. Those two institutions were merged and moved to Bandung in 1918, currently known as PT Bio Farma. In 1902, the government changed Pare Vaccinogène Weltevreden to Landskoepokinrichting and continued to include the Pasteur Institute as an integral part of this institution. Oudheidkundige Dienst (ancient ministry) was officially established by the Dutch East Indies government in 1913). In 1923, the Bataviaasch Genootschap changed to Koninklijk Bataviaasch Genootschap van Kunsten en Wetenschappen. On January 26, 1950, Koninklijk Bataviaasch Genootschap van Kunsten en Wetenschappen was renamed to Indonesian Cultural Institute. In 1928, the government established the "Natuurwetenschappelijke Rand voor Nederlandsch Indie", which was established to coordinate research and act as a liaison between scholars in Indonesia and abroad and also as an advisor to the government on natural science matters. It was then followed by the Organisatie voor natuurwetenschappelijk onderzoek in 1948.

Indirectly, the presence of various scientific institutions encouraged the establishment of educational institutions in the Dutch East Indies. Treub analyzed the causes of failure in the widespread dissemination of science to indigenous communities. Treub saw that the best way to educate the native elite to become scientists was through educational institutions. In the future, they would be the ones to spread this science to society at large (Nijmeegsch Dagblad, 1959). Treub's vision was to create a class in society, namely, native administrators who were scientifically educated and would later act as intermediaries for the needs of European rulers and native communities (Kartawinata, 2006). The proposed school opened in mid-1903 according to Treub's plan, and the government would issue five scholarships annually, four of which were intended for Europeans. Koningsberger also wrote a report in which he admitted that in 1909, Treub had yet to anticipate that apart from scientific-technical matters, the Ministry of Agriculture also needed to be involved with economic issues (Goss, 2014; Kartawinata, 2006). Treub's populist ideas were hampered by a vision of Dutch colonialism, which feared that the progress of the natives themselves could threaten their political power (Nijmeegsch Dagblad, 1959). As a result, science remained the achievement of an elite with little authority in Indonesian society. In 1911, the Dutch East Indies Natural History Association decided to continue serving the interest of amateur researchers in natural history. This popular movement was limited to a small group of Europeans, with its peak in 1929 when their journal De Tropische Natuur (Tropical Nature) had 1,000 subscribers (Goss, 2014; Kartawinata, 2006; Soerohaldoko & dkk, 2006).

For native intellectuals in the 1920s, it slowly became apparent that the government had never intended to provide access to the power of science. Junghuhn's naturalism, Treub's scientific agriculture, and other technocratic ambitions were never fulfilled due to the economic pragmatism of the colonial state, and the purpose of recruiting scientists by the state was actually to carry out administrative tasks

(Goss, 2014; Purwantoro, 2000). Additionally, the Great Depression created a barrier to relations between science and the state as colonial government budgets shrank (Wardani, 2016). The institutions that were hit the hardest were the institutions and employees tasked with developing the economy of indigenous communities. The Great Depression left the colonial government with funding difficulties; thus, science and the colonial government parted ways after decades of close collaboration. European scientists (including the Netherlands) saw that their position needed to be stronger politically; they had to look for other ways to maintain the vision of science for the society's enlightenment, including developing educational institutions. Initially, the engineering faculty in Bandung had only one curriculum and degree, namely civil engineering. The government took over this faculty in 1924. Towards the end of Dutch rule, various scientific activities increasingly came under government control. The political vision of colonial bureaucrats changed slightly when Van Mook arrived. Under Van Mook's leadership, one of his dreams of a technocracy, namely state-supported centralized science, became a reality. Hubertus J. van Mook, who worked in the Department of Economic Affairs after 1934, believed he could transfer power from civil government field officials to the hands of centralized government institutions such as the Department of Economic Affairs. It was hoped that this department would provide the basis for expert power, with specialists in social policy, economics, and science directly influencing colonial executive policy (Goss, 2014; Honig & Verdoon, 1945).

Conclusion

The process of institutionalizing science and technology in the Dutch East Indies at least went through the stages of the emergence of amateur scientists from Europe, efforts to build scientific groups, and the establishment of scientific institutions. In the guise of naturalists and amateur scholars, explorers were replaced by scientific institutions in the 19th century. Developing science and technology in the Dutch East Indies was closely related to Dutch colonial politics. Colonial politics intersected with Dutch scientists' interest in the natural conditions of Indonesia, which has a tropical climate rich in diversity of flora and fauna. The institutionalization of science in the Dutch East Indies was pioneered by the establishment of the Bataviaasch Genootschap voor Kunsten en Wetenschappen and flora crats, which began with various research into the acclimatization of quinine and the expansion of the Buitenzorg (Bogor) Botanical Gardens in the 1900s.

Institutionalizing science and technology requires infrastructure supporting the institution's running through human resources and infrastructure, including funding. Therefore, Dutch scientists who realized this demanded that the colonial government build quality educational institutions in the Dutch East Indies, which had just been discovered in the 20th century. The funding factor was the main factor in the dependence of scientific institutions on the government. European scientists in the Dutch East Indies could not independently form and develop their research without government funding. The institutionalization of science was marked by the establishment of the Bataviaasch Genootschap voor Kunsten en Wetenschappen, Bogor Botanical Gardens and Cibodas Botanical Gardens, Natuurkundige Vereeniging in Nederlandsch Indie, Landskoepok Inrichting, Landskoepokinrichting, Instituut Pasteur and Parc Vaccinogenne, Oudheidkundige Dienst, and Natuurweteschappelijke Raad Voor Natuurwetenschappelijk Onderzoek. Unfortunately, research institutions remained the preserve of elite groups even after Indonesia's independence.

Bataviaasch Genootschap was founded in 1778 to advance scientific and technological knowledge in the Dutch East Indies region. Since its founding, Bataviaasch Genootschap has published many publications, including the scientific journals known as "Verhandelingen" and "Tijdschrift voor Indische Taal-, Land-, en Volkenkunde." These publications are a crucial reference source for scientists and researchers interested in Indonesia's and Southeast Asia's languages, cultures, history, and geography. Previous studies focused on the development of science and did not examine the works of Bataviaasch Genootschap, which examined social changes in Dutch East Indies society. Bataviaasch Genootschap's works discuss indigenous people's culture, literature, society, and history in detail. Using a diachronic approach and comparing research from one period to another will reveal changes in Dutch East Indies society, both native and European. This research does not discuss the role of natives in the institutionalization of science, which needs to be followed up with subsequent research that explores the role of natives in the development and institutionalization of science. Before independence, all research and technology development activities were carried out by the Dutch intellectual elite, using European scientific traditions, and there was no evidence of significant contributions from natives. For native

intellectuals in the 1920s, it slowly became apparent that the government had never intended to provide access to the power of science. However, Dutch scientists such as Junghuhn also wanted to form an elite group of scientists in the Dutch East Indies consisting of Europeans and native elites.

References

Adam, A. . (2009). *Sarwono Prawirohardjo: Pembangun Institusi Ilmu Pengetahuan di Indonesia [Sarwono Prawirohardjo: Builder of Scientific Institutions in Indonesia]*. LIPI Press.

Amir, S. (2009). Challenging Nuclear: Antinuclear Movements in Postauthoritarian Indonesia. *East Asian Science, Technology and Society: An International Journal*, *3*(2–3), 343–366. https://doi.org/10.1215/s12280-009-9091-8

ANRI. (1783-1802). *Notulen Rapat Direksi tgl Bataviaasch Genootschap Juli 1783 - Desember 1802*.

ANRI. (1869-1870). *Notulen Rapat Direksi tgl 05. 10. 1869, 09. 11. 1869, 04. 01. 1870, 01.02. 1870, 05. 04. 1870, 03. 05. 1870, 14. 06. 1870, 12. 07. 1870, 09.08. 1870, 08. 11. 1870, 20. 12. 1870, disertai lampiran (tersimpan dalam berkas nomor KBG DIR 0307)*.

ANRI. (1778-1779). *Notulen Rapat Bataviaasch Genootschaap Juni 1778 - Juni 1779; 03.08. 1778; 07. 09. 1778; 05. 10. 1778; 02. 11. 1778; 07. 12. 1778; 04.01. 1779; 01. 02. 1779; 27. 02. 1779; 08. 03. 1779; 12. 04. 1779; 03.05. 1779; 10. 05. 1779; 07. 06. 1779;*

Beer, L. de. (2014). Voor iedere vriend van de wetenschap. Het publiek van het naturaliënkabinet van de Hollandsche Maatschappij der Wetenschappen in de jaren 1772–1830. *Studium*, *7*(1), 19. https://doi.org/10.18352/studium.9428

Besari, M. . (2008). *Teknologi di Nusantara: 40 Abad Hambatan Inovasi [Technology in the Archipelago: 40 Centuries of Innovation Barriers]*. Penerbit Salemba Teknika.

Cœdès, G. (1913). Bataviaasch Genootschap van Kunsten en Wetenschappen: Dr. NJ Krom: Verhandelingen, deel IX: Oud-javaansche Oorkonden nagelaten transcripties van wijlen; Dr …. *Bulletin de l'École Française d'Extrême-Orient*. https://www.persee.fr/doc/befeo_0336-1519_1913_num_13_1_2802

Goss, A. (2014). *Belenggu Ilmuwan dan Pengetahuan dari Hindia Belanda hingga Orde baru [The Shackles of Scientists and Knowledge from the Dutch East Indies to the New Order]*. Komunitas Bambu.

Gottchalk, L. (1986). *Mengerti Sejarah [Understand History]*. UI Press.

Groot, H. (2009). *Van Batavia Naar Weltevreden, hlm. Het Bataviaash Genootschap Kunsten en WetenSchappen 1778-1867*. Leiden:KITLV.

Het nieuws van den dag voor Nederlandsch-Indië. 1932.

Hill, H. (1995). Indonesia's great leap forward? Technology development and policy issues. Bulletin of Indonesian Economic Studies. *Bulletin of Indonesian Economic Studies*, *31*(2), 83–123. https://doi.org/10.1080/00074919512331336795

Honig, P., & Verdoon, F. (1945). *Science and Scientist in the Netherlands Indies*. Board for Netherlands Indies, Suriname,and Curacao.

Imron, A., Susanto, H., & Atika, W. (2021). Bumiputera Teacher In Ethical Politics. *Jurnal Pendidikan Dan Penelitian Sejarah*, *9*(1).

Kartawinata, K. (2006). *Enam Dasawarsa Penelitian Vegetasi Alami di Indonesia. Soemodihardjo,S. & Sastrapradja,S.D.(ed).(2006).Enam Dasawarsa Ilmu dan Ilmuwan di Indonesia*. Naturindo.

Kate, M. S. (1907). *De Compagnie's kamer van het Museum van het Bataviaasch Genootschap van Kunsten en Wetenschappen*. Albrecht \& Company.

Koswara, J. (2006). *Pembinaan Penelitian dan Pengabdian kepada Masyarakat di Pendidikan Tinggi di Indonesia. Soemodihardjo,S & Sastrapraja,S.D.(ed).(2006). Enam Dasawarsa Ilmu dan Ilmuwan di Indonesia*. Naturindo.

Nijmeegsch Dagblad, 15 Agustus 1959. *Biografie van Melchior Treub: werk over energiek geleerde Plantentuin te Buitenzorg onder hem wijvermaard*.

Purwantoro, R. . (2000). *Koleksi Palem Kebun Raya Cibodas*. Seri Koleksi Kebun Raya-LIPI.

Rengers, D. W. V. W. (1947). Governor General Baron van der Capellen (1819–1826). *The Failure of a Liberal Colonial Policy …*. https://doi.org/10.1007/978-94-015-0953-4_5

Rotterdamse courant, 14 Februari 1786

Sjamsuddin, H. (2007). *Metodologi Sejarah [Historical Methodology]*. Penerbit Ombak.

Soegiarto, A. (2006). *Enam Dasawarsa Kemajuan Dan Pencapaian Ilmu Kelautan Untuk Pembangunan Nasional di Indonesia.Soemodihardjo,S & Sastrapradja,S.D.(ed).(2006).Enam Dasawarsa ilmu dan ilmuwan di Indonesia*. Naturindo.

Soerohaldoko, S., & dkk. (2006). *Sejarah Kebun Raya Cibodas*. Kebun Raya Cibodas LIPI.

Sudarijanto, C. (1992). *Teknologi di Indonesia: Riwayat, karya, dan tantangannya*. Persatuan Insinyur Indonesia.

Sulistyo-Basuki, L. (1998). The rise and growth of libraries in pre-war Indonesia. *Library History*. https://doi.org/10.1179/lib.1998.14.1.55

Van Berkel, K. (2013). Empire without science? The Dutch scholarly world and colonial science around 1800. *Empire and Science in the Making: Dutch Colonial Scholarship in Comparative Global Perspective, 1760–1830*, 89–108.

Wardani, D. T. (2016). Peranan Surat Kabar Soerapati dalam Perlawanan Intelektual Pribumi di Jawa Barat Tahun 1923-1925. *Patanjala: Journal of Historical and …*. http://ejurnalpatanjala.kemdikbud.go.id/patanjala/index.php/patanjala/article/view/54

Zen, M. . (2006). *Mengejar pelangi emas. Soemodihardjo, S. & Sastrapradja, S. D. (ed). (2006). Enam daswarsa ilmu dan ilmuwan di indonesia*. Naturindo.