

The Historical Analysis of the Development and Maintenance of Irrigation Infrastructure in the Pekalongan Residency During the Great Depression in the 1930s

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Abstract: During the Dutch colonial era, the Pekalongan Residency was a key center for the sugar industry, supported by advanced irrigation systems. However, during the great depression of the 1930s, this sector declined, affecting production activities, sugarcane cultivation, and the utilization of irrigation infrastructure. Despite these challenges, the Dutch colonial government continued to pursue large-scale irrigation infrastructure projects even as the state's financial situation deteriorated. This research aims to analyze the history of irrigation infrastructure development and maintenance in the Pekalongan Residency during the 1930s great depression. The research employed historical methods that systematically encompassed the stages of heuristics, source criticism, interpretation, and historiography. The findings revealed that irrigation played a crucial role in the Pekalongan Residency as the primary source of water for plantations and agriculture. During the great depression, the development and maintenance of irrigation infrastructure persisted, relying on government funding. The main factors driving these projects were not only to support plantation and agricultural irrigation but also to alleviate local poverty. Therefore, the government demonstrated its intervention in addressing the problems faced by the population of the Pekalongan Residency by creating employment opportunities through long-term irrigation projects.

Abstrak: Pada masa kolonial Belanda, Karesidenan Pekalongan merupakan salah satu pusat industri gula yang penting dan ditopang oleh sistem irigasi yang maju. Namun, pada masa depresi besar tahun 1930-an, sektor tersebut mengalami kemunduran yang berdampak pada kegiatan produksi, penanaman tebu, dan pemanfaatan infrastruktur irigasi. Di tengah berbagai kesulitan itu, pemerintah kolonial Belanda tetap melanjutkan proyek-proyek pembangunan infrastruktur irigasi berskala besar meskipun kondisi keuangan negara terus memburuk. Penelitian ini bertujuan menganalisis sejarah pembangunan dan pemeliharaan infrastruktur irigasi di Karesidenan Pekalongan pada masa depresi besar tahun 1930-an. Penelitian menggunakan metode sejarah yang secara sistematis mencakup tahapan heuristik, kritik sumber, interpretasi, dan historiografi. Hasil penelitian menunjukkan bahwa irigasi memegang peranan penting di Karesidenan Pekalongan sebagai sumber air utama bagi perkebunan dan pertanian. Pada masa depresi besar, pembangunan dan pemeliharaan infrastruktur irigasi tetap berlangsung dengan mengandalkan pembiayaan pemerintah. Faktor utama yang mendorong proyek-proyek tersebut tidak hanya untuk menunjang pengairan perkebunan dan pertanian, tetapi juga untuk menanggulangi kemiskinan penduduk setempat. Dengan demikian, pemerintah menunjukkan bentuk intervensinya dalam mengatasi persoalan yang dihadapi penduduk Karesidenan Pekalongan melalui penciptaan lapangan kerja dalam proyek irigasi jangka panjang.

INTRODUCTION

Colonialism is directly connected to the exploitation of a colony's natural resources and people. In the Dutch East Indies, the colonial government pursued policies centered on the extraction of natural resources. Fertile lands were utilized to maximize agricultural and plantation commodities, with modern irrigation infrastructure



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playing a key role in supporting this objective. Since the nineteenth century, the Dutch colonial administration had made intensive efforts to develop irrigation infrastructure, particularly during the periods of economic liberalization and the Ethical Policy (Ravestijn, 2005: 202; Lukito, 2017; Hartatik, 2022: 130). However, these efforts did not always proceed smoothly, as the global economy collapsed under the Great Depression of the 1930s. For the Dutch colonial government, the depression caused a sharp decline in tax revenues within only a few years (Ravestijn, 1997: 268).

Amid severe financial constraints, the colonial administration nevertheless decided to continue building irrigation infrastructure on the island of Java, including several projects in the Pekalongan Residency. This decision stood out as an anomaly against the backdrop of a global economic downturn. In the Dutch East Indies, numerous private companies went bankrupt and ceased operations, while others attempted to save their finances by dismissing workers and cutting wages (Wie, 1994: 55; Utomo, 2020: 69). At the same time, irrigation infrastructure projects demanded large sums of money. J. Stroomberg (2018: 228), Head of the Trade Division at the Department of Agriculture, Industry, and Commerce in the Dutch East Indies, noted that the colonial government had allocated approximately 160 million guilders to construct irrigation, drainage, and flood-control systems.

The main objective of this research is to explain why the Dutch colonial government pursued irrigation infrastructure projects in the Pekalongan Residency during the 1930s Great Depression and to examine the processes of their construction and maintenance. The Pekalongan Residency was known as one of the largest sugar-producing regions in Southeast Asia, with extensive sugarcane plantations, and also as a rice-producing area cultivated by indigenous farmers. These agricultural and plantation activities required large volumes of water, which could only be met through adequate modern irrigation systems (Wasino & Hartatik, 2017: 95). Nonetheless, the decision to develop modern irrigation infrastructure raises questions, given that it occurred at a time when the colonial economy was experiencing a severe downturn and plantation activities were declining due to a significant drop in sugar sales in the 1930s.

Several scholars have examined the history of irrigation in Indonesia, particularly during the Dutch colonial period. Nawiyanto *et.al.* (2024) highlighted the role of the Japanese government in developing irrigation infrastructure in Indonesia

from the 1960s to the 1990s, especially along the Brantas River, primarily through periodic funding. This infrastructure proved highly effective in providing benefits to a wide range of people. Ravestijn (1997) investigated irrigation in Java between 1832 and 1942, dividing his analysis into three key phases: the initial stage of irrigation development (1830–1885), the completion of the first major projects (1885–1920), and the full series of projects (1920–1942). According to Ravestijn, the development of irrigation was influenced by several factors, including technological advances, government policy, and the growing demand for irrigation infrastructure. Ertsen (2010) explored the historical evolution of Dutch colonial irrigation practices in the Indies, paying particular attention to the development of irrigation schools and their trajectories after Indonesia's independence. Ertsen concluded that Dutch irrigation engineers in the Indies played a pivotal role not only in constructing irrigation infrastructure but also in improving the lives of the local population.

Drawing on these earlier works, the historiography of irrigation has primarily focused on (1) the role of engineers in irrigation development, (2) the trajectory of irrigation infrastructure in Java, and (3) the role of the government in infrastructure development. In addition, previous studies tend to cover broad temporal and spatial scopes (particularly Java as a whole), which often results in overlooking fine-grained details by depicting events only in general terms. As a consequence, questions remain unanswered regarding irrigation infrastructure in the Pekalongan Residency during the 1930s great depression. Specifically, this research seeks to address the following questions: (1) What was the role of irrigation infrastructure in the Pekalongan Residency? (2) How did the great depression which led to a decline in agricultural and plantation exports affect the utilization of irrigation infrastructure in the Pekalongan Residency? (3) Why did the colonial government undertake large-scale construction and maintenance of irrigation infrastructure when its financial resources and the broader economy of the Dutch East Indies were under severe strain due to the great depression?

METHODS

This research employed a historical method to analyze the economic dynamics and infrastructure policies of the colonial government in the Pekalongan Residency. The historical method comprised a set of principles developed to infer ideas from facts documented and critically examined (Simiand, 1985:

164). In this article, the historical method consists of four analytical stages: (1) source tracing or heuristics, (2) source criticism, (3) interpretation, and (4) historiography (Herlina, 2020: 30). Source tracing was carried out through data collection at the Central Java Provincial Archives and Library Service, the Central Java Provincial Library, and the Pemalang Regency Archives and Library Service. In addition, archival research was conducted digitally by exploring websites providing historical sources. From these searches, official Dutch colonial government publications, newspapers, photographs, journal articles, and similar materials were gathered and used as references for this research.

After the sources were collected, they were assessed (source criticism) for their truthfulness and credibility (Wasino & Hartatik, 2018: 12). This testing was conducted through corroboration (cross-referencing) to ensure that the data and facts obtained were reliable and credible. These data and facts were then interpreted using theories relevant to the research problem. In this research, the Keynesian approach formulated by John Maynard Keynes in *The General Theory of Employment, Interest and Money* was employed to analyze the background of the Dutch colonial government's continued development and maintenance of irrigation infrastructure during the 1930s depression, at a time when government finances were unstable.

The Keynesian approach emphasizes the government's role in addressing economic crises by increasing public spending such as on infrastructure and social programs to stimulate demand and create employment (Keynes, 1936). Keynes, in his book published during the Great Depression, also argues that monetary and fiscal policy play crucial roles in economic stabilization under almost all cir-

cumstances (Eichengreen, 2020: 24). During the great depression, the Dutch colonial government, as the highest authority, wielded significant influence in determining economic and financial policy. Thus, this theoretical framework helps explain the colonial government's decisions regarding the construction and maintenance of irrigation infrastructure during the depression, along with the underlying rationale for these policies. Nevertheless, no factual connection exists between Dutch colonial government policies and Keynesian perspectives. In this research, Keynesian theory is utilized strictly as a theoretical framework for analytical purposes.

The facts obtained through interpretation were then synthesized at the historiography stage. These facts were organized chronologically and systematically to produce an academically accountable narrative. The construction and maintenance of irrigation infrastructure during the 1930s depression were diachronic events; hence, their writing also pays attention to chronological and systematic aspects. In other words, the historiography stage constitutes the writing phase, reconstructing past events based on the interpretation of facts (Herlina, 2020: 30).

RESULTS AND DISCUSSION

The Role of Irrigation in the Pekalongan Residency

The Pekalongan Residency was an administrative region under the Dutch colonial government. In the 1930s, it comprised the Regentschappen of Brebes, Tegal, Pemalang, Pekalongan, and Batang (Regeerings Almanak Voor Nederlandsch-Indië 1934: 328; Dinas Kearsipan dan Perpustakaan Provinsi Jawa Tengah, 1933: 1). The Residency government was headed by a Resident based in Pek-

Table 1. Area of Sugarcane Land in the Pekalongan Residency Sugar Factories, 1913–1918 (in hectares)

Name of Factory	Year					
	1913	1914	1915	1916	1917	1918
Petarukan Sugar Factory	497	1.001	896	1.012	1.013	1.012
Sumberharjo Sugar Factory	-	710	701	707	730	732
Comal Sugar Factory	1490	1377	1575	1646	1665	1668
Gula Pangka Sugar Factory	531	547	752	948	1043	1102
Adiwerna Sugar Factory	691	678	692	716	766	781
Pagongan Sugar Factory	546	550	546	570	573	575
Tirto Sugar Factory	761	799	708	721	715	868
Jatibarang Sugar Factory	886	893	882	1077	1227	1233
Banjaratma Sugar Factory	639	591	797	852	856	931

Source: Harreveld, 1926: 330–363.

Table 2. Dams in the Pekalongan Residency in 1920

Name of Dam	Regency
Sungapan Dam	Pemalang
Nambo Dam	Pemalang
Sokawati Dam	Pemalang
Mejagong Dam	Pemalang
Nambo Dam	Brebes
Cibendung Dam	Brebes
Pesayangan Dam	Tegal
Sidapurna Dam	Tegal
Kaliwadas Dam	Pekalongan
Padurekso Dam	Pekalongan

Source: Angoedi, 1984; Matray, 1936; Ravestijn, 1997; Utomo, 2021.

alongan. In carrying out his duties, the Resident was assisted by Assistant Residents assigned to each regentschap. Each regentschap (kabupaten) was led by a Regent (bupati) from the indigenous elite (Bumiputra), who in turn was assisted by a Patih in the execution of administrative duties.

The Pekalongan Residency has been known as a fertile region since the era of the Islamic Mataram Kingdom (Wasino & Hartatik, 2017: 65). At that time, rice was the primary agricultural product. Under colonial rule, agricultural and plantation activities expanded, with the introduction and cultivation of new crops in the Pekalongan Residency. This intensification of agriculture and plantations occurred widely across the Dutch East Indies, increasing the demand for irrigation to ensure a reliable water supply. In agricultural and plantation activities, water is a critical factor whose scarcity can hinder plant growth and productivity; thus, irrigation infrastructure has become the primary solution to address these challenges.

Irrigation is generally defined as the practice of supplying water beyond what is provided by rainfall to the soil to enhance the growth and yield of agricultural or plantation crops (Sojka *et.al.*, 2002: 745). In another sense, irrigation can be defined as human efforts to obtain water using artificial structures and channels to support agricultural production (Prapti & Sari, 2016: 1). Additionally, irrigation can be understood as the effort to supply, regulate, and dispose of irrigation water to support agriculture, encompassing several types such as surface irrigation, swamp irrigation, groundwater irrigation, pump irrigation, and aquaculture irrigation (Sutopo & Utomo, 2019: 10). Based on these concepts, irrigation may thus be seen as a water management infrastructure developed for human use, especially for agriculture and plantations.

Irrigation played an essential role in agricultural and plantation activities in the Dutch East Indies. Under Dutch colonial rule, irrigation was reconceptualized along modern lines. Traditional irrigation systems built by indigenous communities were considered ineffective at solving paddy field irrigation problems. The dams they built were constructed from materials such as gravel, bamboo barriers, branches, and soil. These limited materials often caused dams to collapse during the rainy season and required rebuilding after floods (Stroomberg, 2018: 227).

Hence, modern irrigation infrastructure was needed one that was durable and capable of accommodating the water needs of agriculture and plantations. Intensive modern irrigation development projects began in the nineteenth century, coinciding with the implementation of the Cultivation System (*Cultuurstelsel*) and the Agrarian Law of 1870 (*Agrarische Wet*) (Wasino & Hartatik, 2017: 96). The government aimed to serve both state and farmer interests by improving water distribution through modern technological systems (Schaik, 2023: 37). By the late nineteenth century, with the Agrarian Law in force, the modernization of infrastructure was increasingly pursued by both the government and private sectors including in the Pekalongan Residency, which at the time occupied a prominent position in the economic landscape of the Dutch East Indies.

The strategic importance of the Pekalongan Residency for the Dutch colonial government in agriculture and plantations dates back to the nineteenth century. By the early twentieth century, the acreage of sugarcane plantations increased significantly during the first three decades of the century (Schaik, 1996: 61). This expansion was driven by the establishment of new sugar factories along Java's northern coast and the growing demand for sugar on global markets. Table 1 shows the sugar factories that expanded their estates, among them Sumberharjo, Petarukan, Comal, Pangka, Adiwerna, Pagongan, Tirto, Jatibarang, and Banjaratma.

Sugarcane, the primary raw material for sugar production, requires large amounts of water, roughly three times as much as rice cultivation (Lucas, 1989: 20). Water therefore became a critical issue for farmers, the government, and the sugar factories alike. The Dutch colonial administration held the political authority to regulate irrigation in the Pekalongan Residency, and with this power the government fully supported the expansion of sugarcane plantations through irrigation infrastructure such as dams and canals. This was all the more nec-

essary because the Dutch East Indies was the largest sugar producer in Southeast Asia and the second largest in the world after Cuba (Tegegn & Dhont, 2023: 3), and sustaining such output demanded robust irrigation. Table 2 lists the dams operating in the Pekalongan Residency by 1920.

In addition to the irrigation infrastructure successfully built and operated during the first three decades of the twentieth century, the Dutch colonial government also planned the construction of new dams before the great depression struck the Indies. In 1926, the Resident of Pekalongan, J.E. Jaspers, reported that the government was preparing to build the Blombong Reservoir in Tegal (ANRI, 1977: xxx). Earlier proposals had been made to construct reservoirs on the Kali Rambut and Kali Gung rivers, though these plans were initially postponed. Nonetheless, these development efforts continued in the years that followed.

Based on the foregoing explanation, irrigation played a crucial role in plantation and agricultural activities in the Pekalongan Residency. The sugar industry's continued upward trend in the early twentieth century, together with local agricultural production, spurred increasing demand for water. The rivers in the Pekalongan Residency were unable to meet water needs evenly, and there were arid lands that required irrigation to be suitable for sugarcane cultivation. In addition, the stark contrast in rainfall between the dry and rainy seasons reinforced the necessity of irrigation infrastructure to ensure effective water management. During the dry season (April–October), rainfall on Java was minimal, and river discharge was greatly reduced. In this period, almost all upstream water sources were diverted to sugarcane plantations (Schaik, 1996: 63). Conversely, during the rainy season (November–March), rainfall was very high (Ertsen, 2008: 23). River discharge increased sharply during the rainy season, often causing floods in the Pekalongan Residency.

The Great Depression and the Decline of Trade Commodities

The Great Depression refers to the collapse of the world economy in the 1930s, a complex and global crisis (Padmo, 2004: 204). The United States experienced the initial Great Depression when stock prices on Wall Street fell sharply in late 1929 (Solimano, 2020: 1; Haberler, 1981: 1; Basundoro, 2023: 125). The 1930s depression was triggered by deteriorating world markets throughout the 1920s (Lindblad, 2016: 22). Industrial activity expanded rapidly in the late 1920s, leading to higher production levels.

However, this increase was not matched by market demand, resulting in overproduction. Such economic imbalances ultimately sent shockwaves through the global economy.

This crisis spread worldwide, including to the Dutch East Indies. By this time, the colonial economy had been deeply integrated into global trade through its export commodities. Like many other countries, the Dutch East Indies had experienced overproduction in the 1920s: tin production rose by 50 percent, coal and oil by almost 100 percent, sugar and tea by 100 percent, copra by 50 percent, and rubber by 200 percent (Vlekke, 2008: 421). Eventually, the Dutch East Indies suffered the severe consequences of the depression. The large volumes of production could no longer be exported due to declining global demand for colonial commodities. Imports into the Dutch East Indies also fell, evident from the declining volume of goods entering Javanese ports (Pemandangan, 21 November 1934).

The depression's impact was acutely felt in the Dutch East Indies in 1931, marked by declines in exports and gross domestic product (GDP). The nadir came between 1932 and 1935, when per capita GDP was about 90 percent lower than in 1930 (Lindblad, 2016: 21). This situation directly affected the colonial government's budget. Between 1930 and 1935, colonial revenues declined sharply, forcing significant spending cuts (Lindblad, 2002: 123; Ingleston, 1988: 295). Private enterprises were also hit hard by shrinking export volumes and falling prices. In 1932, the export index of the Dutch East Indies dropped by 14 percent (Wilde & Moll, 1936: 11). Trade commodities such as rice and copra saw drastic price declines (Vries, 1985: 85).

The industries in the Pekalongan Residency were also affected by the great depression. One of the main reasons was that the Residency of Pekalongan constituted a key area for the development of the sugar industry in Java (Knight, 2002: 182).

Table 3. Average Daily Wages of Permanent Employees at the Comal Sugar Factory in 1930 and 1935 (in cents)

Position	Upah	
	1930	1935
General Assistant	51	35
Coolie	116	96
Factory Guard	95	52
Plantation Guard	40	30
Plantation Coolie	38	19
Factory Laborer	40	25
Office Clerk/Staff	78	33

Source: Schaik, 1996: 71.

The Javanese sugar industry had developed since the mid-nineteenth century as a capital-intensive enterprise whose expansion depended on continuous access to land, labour, and above all a dependable supply of water, as the trajectory of the Mangkunegaran sugar enterprises demonstrates (Wasino et al., 2019). During the depression, sugar was among the commodities that experienced a sharp decline in export volumes, further exacerbated by overproduction. As a result, production outputs could not be distributed and instead accumulated in the factories, worsening the companies' financial balance sheets. At that time, only four sugar factories continued operating in the Pekalongan Residency (Schaik, 1996: 49). Several factories temporarily ceased production and resumed operations in 1934 (De Locomotief, 16 April 1935; De Locomotief, 31 September 1935). Consequently, sugar production in the early 1930s was relatively low.

In general, sugar factories adopted wage reduction policies, cutting workers' pay by 10 percent as of January 1, 1932. Layoffs were also carried out as part of rationalization measures. The contraction of employment opportunities during the Great Depression had serious consequences, particularly for plantation laborers (Levert, 1934: 279). These measures exposed the structural vulnerability of the peasantry within the plantation economy: villagers depended simultaneously on wage labour in the factories and on their own rice fields, so a contraction in one sector immediately eroded the other (Wasino & Hartatik, 2017). The number of workdays available for land cultivation also fell in 1931, 1932, and 1933 compared to 1930. The Comal Sugar Factory, widely regarded as a symbol of the sugar industry's advancement in the Pekalongan Residency, also carried out rationalization. Its workforce declined from 1,400 to 900 by 1935 (Schaik, 1996: 79). In addition, the daily wages of permanent employees were sharply reduced, in some cases by up to 50 percent between 1930 and 1935. Table 3 illustrates these wage cuts.

The decline in sugar exports and industrial activities also affected the extent of land allocated for sugarcane cultivation. In the Pekalongan Residency, sugarcane acreage decreased in line with reduced production due to weakened market demand. During the 1932/1933 planting season, sugarcane plantations in Pekalongan and Tegal covered 9,176 hectares, but by the 1933/1934 season this area had fallen to 2,660 hectares (Indisch Verslag 1934, 1934: 5). The contraction in sugarcane cultivation was also closely linked to Dutch colonial government policies, which temporarily

rejected applications for the establishment and expansion of sugar enterprises in response to the crisis (Levert, 1934: 273). This policy was formally codified in *Gouvernementsbesluit* of 6 January 1933, No. 33. Since sugarcane cultivation required substantial amounts of water, the reduction in cultivation areas inevitably influenced water demand and the use of irrigation infrastructure. The contraction of sugarcane acreage therefore represented not merely a reduction in output but a reconfiguration of land use across the northern coastal plain, a process in which colonial infrastructure consistently operated as a determinant of how land was allocated between estate and subsistence cultivation (Hartatik et al., 2022).

Sugarcane planting began to improve in 1936, when sugar factories in the Pekalongan Residency were granted permission by the Dutch colonial government to resume large-scale planting. The Sragi Sugar Factory was allocated 500 hectares, the Comal Sugar Factory 1,000 hectares, the Petarukan Sugar Factory 1,000 hectares, the Pangka Sugar Factory 1,000 hectares, the Sumberhardjo Sugar Factory 1,200 hectares, the Ketanggungan Sugar Factory 1,400 hectares, and the Bandjaratma Sugar Factory 1,300 hectares (De Locomotief, 13 February 1936). Nevertheless, these developments did not signify a full restoration of the sugar industry to its pre-depression conditions, as it remained under the shadow of the economic downturn.

Irrigation Development during the Great Depression

The critical role of irrigation infrastructure for colonial lands prompted the Dutch colonial government to pursue irrigation development in strategically significant areas. In the Pekalongan Residency, irrigation infrastructure projects continued throughout the 1930s, even as the Dutch colonial government faced severe financial turmoil due to the Great Depression. This policy raises questions, as the period was marked by a contraction of sugarcane cultivation and a general decline in agricultural activity. The decision to construct irrigation infrastructure particularly dams during the depression involved considerable risk, given the unfavorable fiscal conditions of the time. Therefore, it is important to investigate both the background and processes underlying this government initiative. The contrast becomes instructive when set against other colonial infrastructure in the same region. The Semarang-Joana Stoomtram Maatschappij, which served the sugar factories of the northern coast, responded to the crisis by curtailing services

and retrenching its network, whereas irrigation works in the Pekalongan Residency were sustained and even expanded (Hartatik et al., 2024).

The Dutch East Indies, particularly Java, was renowned for its vast and sophisticated irrigation system, which was regarded as exemplary worldwide (*De Sumatra Post*, 17 February 1932). The construction of irrigation infrastructure during the colonial era was entrusted to a specialized institutional structure. At the central level, irrigation development fell under the authority of the *Departement van Burgerlijke Openbare Werken* (Department of Civil Public Works). At the provincial level, it was managed by the *Provinciale Waterstaatsdienst*, headed by the *Hoofd Provincie Waterstaatsdienst* (HPW). Beneath this body, institutions operated tailored to their respective administrative areas. The Pekalongan Residency, located within the administrative jurisdiction of *Provincie Midden Java*, was overseen by the *Irrigatie-Afdeeling Pemali-Tjomal*. This office supervised the *Afdeeling Pemali-Comal*, the irrigation region of the Pekalongan Residency, named after the Pemali and Comal Rivers. The institution was headed by a Dutch official (*Hoofdingenieur*) appointed by the government, assisted by several mid-level technicians (*opzichters*) (Angoedi, 1984: 88). At the local level, irrigation foremen (*Mantri Irigasi*) were tasked with regulating water distribution to rice fields and plantations.

Within this organizational structure, Europeans dominated the strategic positions, underscoring the colonial government's vested interest in irrigation and the racialized power relations that placed Europeans above the *Bumiputra* (indigenous population) in managing and constructing irrigation infrastructure. More broadly, Dutch officials were not only instrumental in the development of modern irrigation systems but also in the formation of a modern colonial society in the Dutch East Indies (Ravesteijn, 2005: 200). Comparable colonial interventions elsewhere in Central Java nevertheless suggest that projects presented as instruments of modernisation frequently reproduced the very hierarchies they claimed to dissolve, distributing their benefits unevenly among the indigenous population (Hartatik et al., 2025). However, their objectives were not always easily realized, especially as the 1930s marked the nadir of the colonial economy under the weight of the global depression.

Despite these challenges, the Dutch colonial government, through its irrigation authorities, undertook high-risk measures by initiating large-scale irrigation projects in the Pekalongan Residency

during the 1930s depression. These efforts materialized in several major projects, including the construction of the *Penjalin Dam* and the *Malahayu Dam*. The Penjalin Dam, located in Brebes within the Pekalongan Residency, began construction in 1930 under the supervision of the *Irrigatie-Afdeeling Pemali-Tjomal*. The project was initially funded with a budget of f190,000, while the Director of the *Departement van Burgerlijke Openbare Werken* was allocated f146,700 for land acquisition (*Het Nieuws van den Dag voor Nederlandsch-Indië*, 11 April 1930). By the end of 1930, the construction budget had risen to f1,200,000, with a significant portion of the funding provided by the surrounding sugar factories (*De Indische Courant*, 5 December 1930).

The construction of the Penjalin Reservoir was supervised by Ir. Führi and Ir. G.A.R. Enserink. The reservoir drew its water from the Pemali River and rainfall, and it was projected as a major irrigation facility capable of holding up to 10 million m³ of water (*Het nieuws van den dag voor Nederlandsch-Indië*, December 12, 1930). Its primary purpose was to meet the water demands of sugarcane plantations, as several sugar factories operated in the surrounding area. However, the Great Depression bankrupted these factories, which had financed part of the construction, and they were forced to withdraw their funding. Nevertheless, the colonial government continued the project by minimizing expenditures. According to J.L. Polderman, Head of the Irrigation Division of Pemali-Tjomal (*Hoofd der Irrigatie-Afdeeling Pemali-Tjomal*) in Tegal, the cost reductions were also meant to ensure that sufficient funds remained for the construction of the Malahayu Reservoir in Brebes, Residency of Pekalongan (*De locomotief*, October 31, 1935). Construction was already well advanced by mid-1934, as shown by the sluice gate inlet (Figure 1) and the intake tower (Figure 2).

The Penjalin Reservoir was completed in mid-1934, following a three-year construction process. The inauguration ceremony was held on Monday, June 18, 1934, attended by the Governor of Central Java (Midden-Java), the Director of Transportation and Public Works (*Directeur van Verkeer en Waterstaat*), relevant officials, and guests (*Algemeen handelsblad voor Nederlandsch-Indië*, June 11, 1934; *De locomotief*, June 12, 1934). The Dutch colonial government regarded the Penjalin Reservoir as a major project with significant potential impact on agricultural and plantation activities in the Residency of Pekalongan, despite its construction and operation during the great depres-

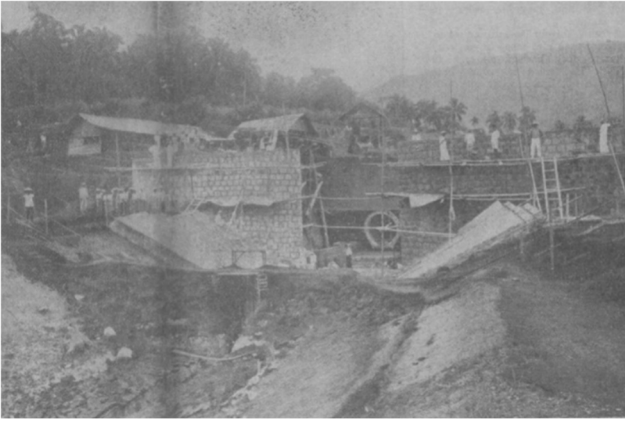


Figure 1. Inlet to the sluice gate of the Penjalin Reservoir under construction. (Source: De Locomotief, June 13, 1934)

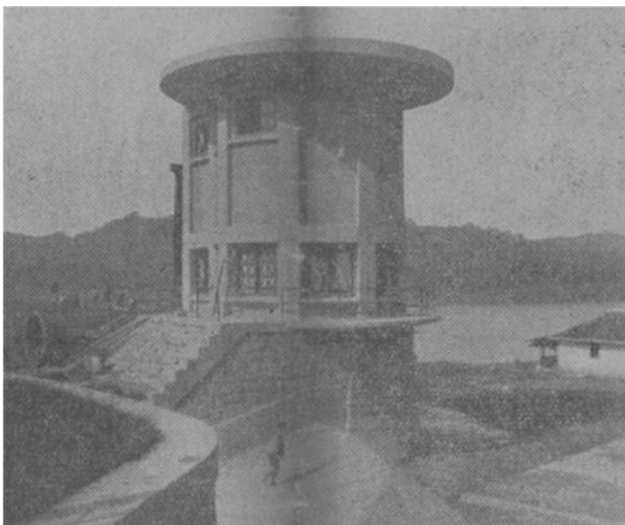


Figure 2. Upper entrance to the Penjalin Reservoir, Brebes, Residency of Pekalongan. (Source: De Locomotief, June 14, 1934)

sion, when agricultural and plantation commodities were experiencing decline. Furthermore, during the inauguration speech for the Penjalin Reservoir, the Regent (*Bupati*) of Brebes stated, on behalf of the local population, that such a well-executed and fruitful irrigation project was vital for agricultural communities, including indigenous people (*Bumiputra*), as it undeniably enhanced public welfare. According to him, through the intensive efforts of the irrigation service, wet-rice cultivation became possible across a designated area of 2,500 bouw, leading to a significant increase in paddy planting an expansion that could only be driven by reservoir construction (De Locomotief, June 20, 1934).

The development of irrigation infrastructure in the Residency of Pekalongan did not end with the Penjalin Reservoir. The Dutch colonial government also pursued the large-scale project of constructing

the Malahayu Reservoir in Brebes, whose construction began in 1935 and was projected for completion in 1940 (Angoedi, 1984: 170; De Indische Verlofganger No. 16, November 12, 1937). The name “Malahayu Reservoir” was derived from the village where it was built. Moreover, the reservoir was situated on the Kabuyutan River, one of the major rivers in Brebes. The Malahayu Reservoir was projected to accommodate 60 million m³ of water, with a base width of 150 meters, and included two additional canals extending from east to west (De Indische Verlofganger No. 16, November 12, 1937). In addition, the reservoir was 30 meters high and was constructed from gravel and sand deposits from the Kabuyutan River, combined with clay sourced from the reservoir basin (Angoedi, 1984: 170). The budget allocated for this large-scale project amounted to f 900,000. Construction relied on manual labor, as shown in Figure 3.

During the construction of the Malahayu Reservoir, the Dutch colonial government faced both technical and financial challenges. The technical difficulties included obstacles during excavation of the sandstone cliffs designated for the 150-meter-long, 30-meter-high dam, which caused a one-month delay. Concrete casting for the foundation of the intake tower was also postponed because of these constraints (De Indische Verlofganger No. 16, November 12, 1937; Figure 4). On the financial side, the 1936 budget was discussed by the Provincial Council of Central Java (Provincialen Raad van Midden-Java) in 1935, and financial assistance for the reservoir was proposed (De locomotief, November 24, 1935). In 1936, an additional f 60,000 was allocated to accelerate construction (De locomotief, December 14, 1936). By 1940, the Malahayu Reservoir had become operational.



Figure 3. Laborers working on the construction of the Malahayu Reservoir. (Source: De locomotief, December 2, 1937)

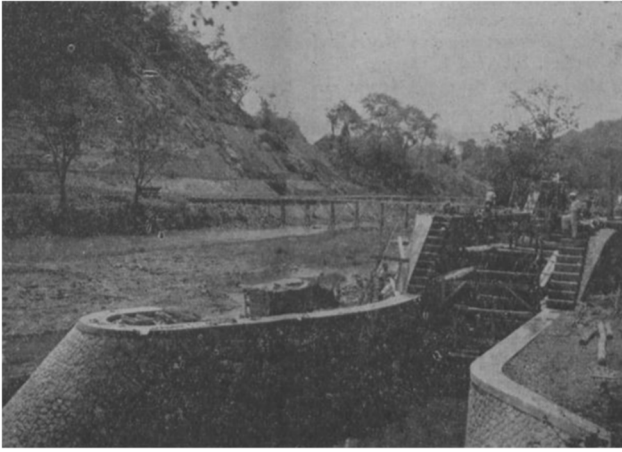


Figure 4. Construction of a water tank at the Malahayu Reservoir. (Source: De locomotief, December 2, 1937)

In general, the objectives of irrigation infrastructure development were to stimulate agricultural growth and political stability, increase production, enhance state revenues, and improve communication and transportation (Kanumoyoso, 2023: 42). Giordano *et.al.* (2023: 3) outline irrigation's goals and benefits in three dimensions. First, irrigation is clearly linked to increased agricultural yields, both through direct production effects and by enhancing the productivity of complementary inputs. Second, irrigation is closely associated with poverty reduction, particularly among direct beneficiaries and urban consumers. Third, irrigation is connected to a variety of other impacts, including nutrition, health, and environmental outcomes.

Such welfare-oriented justifications were not confined to the irrigation service. Within the Javanese sugar industry itself, enterprises had long institutionalised forms of social provision for the surrounding population, so that the colonial state's framing of the reservoirs as instruments of poverty relief drew on an established repertoire of paternalistic practice rather than representing a sudden humanitarian turn (Wasino et al., 2026). The Resident of Pekalongan, C.O. Matray, expressed the expectation that major projects such as the construction of the Malahayu and Penjalin Reservoirs would significantly improve the welfare of the population in the Residency of Pekalongan (De locomotief, September 3, 1934). Residents not only received wages as laborers for reservoir construction but also obtained compensation from land acquisition (De Indische courant, May 18, 1935). The Regent of Brebes also stated that through the irrigation development project, the government had provided employment opportunities for the residents of the Bumiayu (Brebes) and its surrounding areas, whose

economic conditions had severely deteriorated in recent years due to various unforeseen circumstances (great depression) (De Locomotief, June 20, 1934). In 1937, the newspaper *Algemeen Handelsblad voor Nederlandsch-Indië* reported that the number of laborers at the Malahayu Reservoir reached nearly 1.000 laborers. Some of these laborers were brought in from Cirebon, a region located to the west of Brebes (Algemeen Handelsblad voor Nederlandsch-Indië, December 3, 1937). These labourers belonged to the stratum of *wong cilik* the smallholders, landless villagers, and casual workers who constituted the base of Javanese rural society and who bore the heaviest burden of the economic contraction (Wasino et al., 2021).

The government also initiated other large-scale projects to increase employment opportunities, including the construction of roads, bridges, and government office buildings (Dinas Kearsipan dan Perpustakaan Provinsi Jawa Tengah, 1934). These projects were carried out by the Dutch colonial government through the Department of Public Works (Departement van Burgerlijke Openbare Werken), the Provincial Water Authority of Central Java (Provinciale Waterstaatsdienst Midden-Java), and other lower-level agencies. Efforts to create employment opportunities through infrastructure development were closely linked to the deteriorating economic conditions in the Dutch East Indies during the Great Depression.

Irrigation Maintenance during the Great Depression

In the Residency of Pekalongan, irrigation infrastructure maintenance was carried out by the Irrigation Division of Pemali-Tjomal (Irrigatie-Afdeeling Pemali-Tjomal), sugar factories, and the Regency Council (Regentschapraad). Maintenance activities were classified into two types: routine maintenance and incidental maintenance to repair infrastructure that was suddenly damaged. Such maintenance was essential to preserve the quality and functionality of irrigation, given that the Residency of Pekalongan relied heavily on agriculture and plantation-based economic activities. Funding for irrigation maintenance and repair in the Residency of Pekalongan was secured through two main mechanisms: first, government funding; and second, contributions collected from sugar factories. However, during the great depression, several sugar factories went bankrupt and could no longer meet their contribution obligations. Sugarcane cultivation also experienced a decline (Hartatik et al., 2024). Nevertheless, some factories continued to

provide contributions to the government in 1930, when the impact of the great depression was not yet fully felt. In subsequent years, the government increasingly relied on its own budgetary allocations amid the prevailing economic hardship. This was particularly important given the geographical conditions of the Residency of Pekalongan, consisting of alluvial plains crossed by rivers, particularly the Pemali and Tjomal, which had already benefited from technical improvements to their irrigation systems in previous years (Departement van Economische Zaken Nederlandsch-Indië, 1934: 10).

Irrigation infrastructure in the Residency of Pekalongan was highly vulnerable to damage because it was located in a flood-prone region. Flood disasters in the area were frequently reported in Dutch colonial newspapers. Damage often occurred to river embankments, dams, and irrigation bridges (De Preanger-bode, March 18, 1903; *Algemeen Handelsblad voor Nederlandsch-Indië*, September 24, 1937; *Algemeen handelsblad voor Nederlandsch-Indië*, November 25, 1938). Hence, budget allocations to address these issues were routinely arranged each year. For example, the Pemalang Regency government earmarked a special allocation for the maintenance of irrigation infrastructure within its territory. This measure was formalized during the Regentschapraad (Regency Council) meeting on the 1938 budget plan. The meeting proposed a special allocation for irrigation-related issues, including the repair of a 400-meter water pipeline at a cost of f 300 and drainage channels on both sides of the city road, spanning 2 × 350 meters, at a cost of f 560 (*Algemeen handelsblad voor Nederlandsch-Indië*, December 29, 1937). In addition, budgetary allocations were also sought for the maintenance of irrigation bridges and culverts in the same year.

A similar initiative was undertaken by the Tegal Regency government, which incorporated irrigation maintenance into its 1935 budget plan. The budget included f 200 for the repair of irrigation bridges and culverts (De locomotief, November 2, 1934). In the 1939 budget planning session, additional funds were allocated for similar purposes, including more than f 2,000 for the repair of a wooden bridge over the Kubanggajara River (De locomotief, December 9, 1938). A much larger allocation was made by the Provincial Government of Central Java (Midden-Java) in 1930, which provided f 2,070,000 for the maintenance of roads, bridges, culverts, and irrigation works (De locomotief, September 28, 1933).

Throughout the 1930s, the Provincial Water Authority of Central Java (Provinciale Waterstaatsdienst Midden-Java) regularly allocated funds for the maintenance and repair of irrigation infrastructure in the Residency of Pekalongan. The expenditures were reported in monthly reports (Provincie Rapport) issued by the Head of the Provincial Water Authority of Central Java. In March 1931, repairs to irrigation bridges and culverts in the Residency of Pekalongan were reported at a cost of more than f 1,000 (Dinas Kearsipan dan Perpustakaan Provinsi Jawa Tengah, 1931). Similar repairs were again reported in December 1935, this time amounting to approximately f 12,000 (Dinas Kearsipan dan Perpustakaan Provinsi Jawa Tengah, 1935).

In the Residency of Pekalongan, the government, through the Irrigation Division of Pemali-Tjomal, also collected contributions from sugar factories to maintain irrigation infrastructure. One such contribution came from the Sragi Sugar Factory, which was required to pay f 2,800 for the maintenance and supervision of irrigation infrastructure along the Sragi River (Dinas Kearsipan dan Perpustakaan Provinsi Jawa Tengah, 1930). These funds were used to pay irrigation guards and laborers, cover painting and pipe maintenance, purchase materials and equipment, and acquire land.

The government also issued incidental budgets to address sudden damage to irrigation infrastructure. In 1937, f1,000 was allocated for the repair of the damaged Nambo Weir. The repairs began at the end of the dry season, leaving very little time before the rainy season. As a result, on certain days, laborers were required to work late into the night to complete the task (*Algemeen Handelsblad voor Nederlandsch-Indië*, September 24, 1937). Flooding remained the greatest threat to irrigation infrastructure, frequently causing severe damage, particularly around the larger rivers.

The large-scale reservoir projects namely the Penjalin and Malahayu Reservoirs together with the routine maintenance of irrigation infrastructure in the Pekalongan Residency, refute Lucas's (1989: 21) argument that investment in irrigation construction and maintenance in Pekalongan came to a halt as a result of the great depression. By collaborating with sugar factories, the colonial government sought to continue irrigation-related projects, thereby absorbing a substantial labor force. The poverty and famine that afflicted the Netherlands Indies during the great depression spurred the government to provide both financial support and employment opportunities for the local population. Wage em-

ployment on the reservoir projects operated alongside village-level institutions that cushioned the crisis, most notably the lumbung *desa*, whose function as a granary and source of rural credit grew more prominent precisely as cash incomes contracted (Hartatik et al., 2023). The Dutch colonial authorities helped by implementing irrigation infrastructure projects to provide wages for labourers. One such initiative was realized in the Pekalongan Residency through the construction of reservoirs and the maintenance of irrigation facilities (Vries, 1985: 40). The local population demonstrated support for the construction project through their willingness to relocate from residential areas designated under the land acquisition plan for the irrigation infrastructure. Nevertheless, in a modern context, the potential role of irrigation in poverty alleviation particularly large-scale irrigation may have shifted, given that areas suitable for new irrigation development have declined and urbanization has increased (Giordano, *et.al.*, 2023: 2).

In addition to the maintenance of irrigation infrastructure following the completion of the Penjalin and Malahayu Reservoirs, the construction and operation of irrigation systems in the 1930s had a tangible impact on the indigenous population (Bumiputra). Consequently, river flows were regulated to ensure adequate irrigation. With the establishment of new irrigation infrastructure, community water capacity expanded by millions of cubic meters, and thousands of hectares of irrigated land were added. Overall agricultural intensity surrounding the reservoirs including the cultivation of rice, sugarcane, secondary crops (palawija), and shallots gradually expanded in terms of cultivated area (Soerabaijasch Handelsblad, September 5, 1937). Rice fields managed by indigenous farmers received water supply from this infrastructure. In 1937, rice yields were categorized as satisfactory, with minimal agricultural pest damage (De Locomotief, July 29, 1937). Similarly satisfactory harvests occurred in 1939 in the Bumiayu, Brebes, where a total area of 29,861 hectares was successfully harvested (De Locomotief, April 6, 1939). Nevertheless, irrigation was not the sole determinant of agricultural success, as other crucial factors existed, such as pest infestation, plant nutrient sufficiency, cropping patterns, and crop care by farmers. The vital role of the Malahayu and Penjalin dams continues to this day, particularly for the Brebes region. Today, these dams have even been developed into tourist destinations (Tim Redaksi, 2026). This underscores how colonial irrigation initiatives were

meticulously planned during their construction process to yield long-term impacts.

CONCLUSION

Irrigation infrastructure played a crucial, strategic role in the Pekalongan Residency, which was one of the most important sugar-producing areas in the Netherlands Indies. The expansion of sugarcane plantations continued throughout the first three decades of the twentieth century, accompanied by rising sugar export values. This expansion was directly linked to the increasing demand for irrigation infrastructure to secure water supplies for sugarcane cultivation. Furthermore, the region's natural conditions, which were not particularly favorable for sugarcane production, reinforced the need for irrigation facilities. However, during the great depression of the 1930s, the sugar industry declined, with several factories ceasing production. This interrelation illustrates the complex nexus between the sugar industry, sugarcane plantations, and irrigation infrastructure.

As the highest authority, the Dutch colonial government took significant risks during the difficult period of the great depression by deciding to proceed with large-scale irrigation infrastructure projects in the Pekalongan Residency. Two of these were the construction of the Penjalin and Malahayu Reservoirs. Although these projects encountered both financial and technical obstacles, the government persisted until their completion. The decision to carry out these projects was grounded in economic reasoning, serving as a form of intervention to address the problems of poverty and famine among the inhabitants of the Pekalongan Residency. The continuation of large-scale irrigation development and maintenance thus stands in stark contrast to the view that such projects ceased during the great depression of the 1930s. Moreover, the irrigation development project in the Pekalongan Residency represents a long-term Dutch colonial legacy that remains operational to the present day, while also developing into a tourist site.

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