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Bharoto Bharoto*
Bandung Institute of Technology
10, Jalan Ganesa, Bandung, Indonesia, 40132
Diponegoro University
Prof. Soedharto, SH. Street, Semarang, Indonesia, 50275
E-mail: bharoto.adiwardojo@gmail.com
https://orcid.org/0000-0003-0108-7673

Himasari Hanan
Bandung Institute of Technology
10, Jalan Ganesa, Bandung, Indonesia, 40132
E-mail: hanan@itb.ac.id
https://orcid.org/0000-0001-8456-7175

Andry Widyowijatnoko
Bandung Institute of Technology
10, Jalan Ganesa, Bandung, Indonesia, 40132
E-mail: andry@itb.ac.id
https://orcid.org/0000-0002-0597-4600

*(correspondent-author)

Institutionalising concrete construction technology: A socio-technical formation of modern architecture in Indonesia

Abstract. *The institutionalisation of construction technology in postcolonial architecture has seldom been studied through Science and Technology Studies, particularly in developing countries where political agendas often shaped modernisation more than industrial growth. This article addresses this gap by analysing the socio-technical process of institutionalising concrete construction technology in Indonesian architecture between 1959 and 1981. Drawing on Berger and Luckmann's social construction theory, especially externalisation and objectivation, the study frames the Old Order and the New Order as successive regimes that produced and stabilised technological meanings within their respective national development narratives. The research investigates presidential speeches, governmental policies, and practitioners' writings to trace historical discourses*

linking technology and national development. Findings indicate that these discourses were initially divergent: the Old Order focused on nation building through monumental projects, whereas the New Order emphasised social welfare through economic growth. Gradually, these contrasting discourses interacted and contributed to the objectivation of concrete as the dominant material and construction method in post-independence Indonesian architecture. Developmental discontinuity under the Old Order (1959–1966) generated modernity arising from economic constraints but marked by innovation through unprecedented concrete applications. In contrast, the New Order (1966–1981) produced modernity characterised by efficiency, utilisation of local materials, and social empathy amid economic surplus. Despite these differences, concrete construction technology persisted architecturally, bridging both regimes. The institutionalisation process thus represents a negotiated socio-technical transition rather than a linear diffusion of modern technology. This Indonesian case contributes to global Science and Technology Studies debates by offering a Southern perspective on how modern architecture materialises through historically and contextually contingent technological constructions.

Keywords: *developmental policy; externalisation; Indonesian modern architecture; objectivation; socio-technical institutionalisation*

Introduction.

This article examines the institutionalisation of concrete construction technology in Indonesian architectural practice as a socio-technical process that unfolded across political regimes. It originated under the Old Order (1945–1966) through the deployment of concrete in monumental state projects and became systematised during the New Order (1966–1998) through large-scale, standardised, and professionally integrated construction practices aligned with national development agendas. Although architectural expressions from these two regimes may appear formally distinct, the continuity of construction technology reveals a deeper structural linkage between them. Investigating this process of institutionalisation is therefore essential to reconstruct historical trajectories and challenge interpretations that view regional architecture merely as stylistic refelections of global trends.

The term New Order refers to the Indonesian government under President Soeharto (1921–2008), which spanned from 1966 to 1998 (Boediono, 2016; Taylor, 2012). This regime represented a decisive departure from the preceding Old Order (1945–1966), whose central policies emphasised decolonisation and national consolidation, typical of a newly independent state (Fakih, 2020; Mustopadidjaja et al., 2012). A pivotal shift during this earlier period, particularly from 1959 onwards, involved the nationalisation of foreign assets and the withdrawal from Western-bloc investments (Bandyopadhyaya, 1977; MacDougall, 1976; Uzair, 1970). The Old Order government rejected the free-market model associated with capitalism and liberalism, opting instead to transfer control of economic activity to the Indonesian people (Fakih,

2020; Zanden & Marks, 2012). These policies, however, led to severe economic decline and ultimately contributed to the collapse of the regime. The New Order sought to reverse this trajectory. In a speech before the Provisional People's Consultative Assembly (DPR-GR) on August 16, 1970, Soeharto articulated the New Order's principal role as rectifying past deviations across all sectors (Mustopadidjaja et al., 2012). One major manifestation of this corrective agenda was the implementation of state-led development policies oriented towards economic growth and modernisation (Bazbauers, 2018; Booth, 2016; Liddle, 1991). Under this regime, national development in Indonesia began to unfold in a more structured and sustained manner (Fuady, 2012, p. 375).

The discussion of concrete construction technology during the Old Order begins in 1959, a year interpreted as marking a disjunction in state policy (Siahaan, 2000; Sopandi, 2017a; Widodo, 2009). In contrast, the analysis of technological developments in New Order architecture concentrates on the period from 1966 to 1981, which encompasses two contrasting phases in Indonesia's economic trajectory. Australian economist Hal Hill (2001, p. 15) identifies the first phase (1966–1972) as a period of economic rehabilitation, characterised by efforts to stabilise and recover from the preceding crisis, while the second phase (1973–1981) is marked by rapid economic growth, driven largely by the surge in global oil prices. The year 1981 serves as a terminus for this study, as it signifies the end of the oil price surge and the consequent shift in the direction and capacity of national development policies.

Scholarly investigations of Indonesian architecture during the Old Order period remain more prominent than those addressing the New Order era. This imbalance is surprising, given that architectural production under the New Order was significantly greater in quantity and displayed characteristics distinct from other periods. Seminal works by Akihary (1990), Passchier (2016), and Norbruis (2020) explore Indonesian architecture primarily up to the 1960s and 1970s, aligning with the Old Order period. Similarly, Kusno (2012), Eryudhawan (2012), and Subijono (2012) emphasise President Sukarno's instrumental role in promoting architectural modernity, in line with Sopandi's (2017b) study on Friedrich Silaban, a key architect active during that time. In contrast, scholarship on New Order architecture remains thematically fragmented, despite notable contributions by Hidayat & Sjarief (2019a, 2019b, 2021), Khudori (2001), Moersid (2015), Odang (1992), Rahardjo & Soerasno (2010), Sukada (2011), and Tjahjono & Agustiananda (2002), who have examined the ideas and works of Indonesian architects during the New Order government. Further enrichment comes from the recent volume edited by Henning and Kögel (2023), which highlights Indonesian architects trained in Germany who were professionally active throughout the New Order period. Nevertheless, most of these studies have yet to adequately engage with the role of construction technology, particularly reinforced concrete technology, and its institutionalisation within New Order architectural practice. Critical assessments of architecture from this era–such as Wiryomartono's (2012, p. 216)

appraisal that it lacks monumentality, innovation, and tends toward conventionalism– often overlook the material and technological frameworks that underpinned it. This gap is further evidenced by the lack of analysis on the continuity between the Old and New Orders, despite both periods exhibiting sustained patterns in the adoption and institutionalisation of concrete construction technologies, which unfolded beyond the logic of formal state policy.

The imbalance in scholarship between Old Order and New Order architecture reveals a lack of attention to construction technology as an integral aspect of the institutional dynamics of modern architecture in Indonesia. This study thus investigates how concrete construction technology became institutionalised within two distinct politico-economic contexts. The analysis employs the perspective of social construction theory to interpret technological practices as products of historically situated negotiations between actors and institutions, legitimised through developmental narratives.

Research Methods.

This study draws upon twentieth-century architectural historiography and Science and Technology Studies (STS) to reconceptualise modern architecture not as a stylistic category but as a socio-technical process of modernisation. It situates the discourse of modern architecture within the epistemological interplay between design practice, construction technology, and developmental governance. Accordingly, the investigation focuses on how the institutionalisation of concrete construction technology mediated the modernisation of architectural practice in Indonesia, positioning architectural modernity as a historically contingent outcome shaped by the political and economic objectives of the state.

Earlier historiography of modern architecture tended to privilege *episteme* - the aesthetic and compositional logic of form (Hirst, 1993), while marginalising *techne*, the procedural intelligence of making (Schatzberg, 2012; Wang, 2013; Miller, 2023). Yet *techne* constitutes the epistemic foundation of technology: whereas *techne* embodies the situated and embodied practices of making, technology denotes an organised assemblage integrating theoretical knowledge, technical mastery, and productive systems oriented toward specific ends (Li-Hua, 2009). The dialectical relationship between these two dimensions, *episteme* and *techne*, underpins the historical process through which architecture becomes modernised, not merely in its formal expression but through the systemic reorganisation of its production and institutional logics.

Guided by Berger and Luckmann's Social Construction of Reality (1966), this study interprets technology as a socially constructed reality produced through dialectical interactions between actors and institutions. Through the processes of externalisation and objectivation, technological meanings are generated, materialised, and legitimised within broader socio-political frameworks. Within this theoretical lens,

the adoption of concrete construction technology in Indonesian architecture is treated as the outcome of historically situated negotiations whose collective actions shaped its legitimacy as an agent of modernisation.

Methodologically, this study employs a qualitative content analysis structured within the conceptual categories of externalisation and objectivation. The primary and secondary historical sources comprise government records, professional monographs, biographies, and national media archives, all publicly accessible materials. These documents provide not only factual evidence but also discursive traces through which actors' intentions, institutional logics, and the socio-technical meanings of modernisation can be discerned. The analysis proceeded through five iterative stages: (1) extracting textual evidence that reveals actors' intentions or institutional narratives; (2) coding these excerpts according to their thematic relevance to externalisation or objectivation; (3) reconstructing, in chronological sequence–the socio-technical trajectories spanning the Old and New Order regimes; (4) interpreting the actions of individual and collective actors who advanced the institutionalisation of concrete construction technology; and (5) relating the institutionalisation of technology to broader patterns of architectural modernisation in Indonesia. The analytical framework moves from Berger and Luckmann's Social Construction of Reality (SCOR) toward the Social Construction of Technology (SCOT), thereby extending the analysis beyond discursive interpretation to the material mediation of technology in architectural practice. Analytical reliability was strengthened through iterative triangulation among textual evidence, theoretical interpretation, and historical context, ensuring that each analytical claim remained reflexively grounded in both empirical and conceptual coherence.

Institutionalisation, in this study, is defined as the convergence of externalised actions and their material objectivation, when technological practices become embedded within the mechanisms of developmental governance. The analysis deliberately excludes the stage of internalisation, focusing instead on how institutionalisation differentiated across political regimes. By mapping both discursive and material transformations, architectural works employing concrete construction are interpreted as tangible objectivations of these social processes. Comparative interpretation between the two regimes reveals how technology functioned as a constitutive agent of architectural modernity under distinct political economies. In doing so, the study extends global historiographical debates by shifting attention from stylistic or regional interpretations toward the institutionalisation of construction technology as a socio-technical process. Accordingly, this study conceptualises architectural modernisation through concrete construction as a non-linear process shaped by contextual contingencies and external influences (Bijker, 1997, 2010; Sismondo, 2011). It thereby challenges centre-periphery narratives and demonstrates how material governance structured the uneven, non-Western trajectories of modernisation.

Results and Discussion.

The modernisation of architecture in Indonesia unfolded differently from other non-Western contexts. Earlier studies rarely employed a socio-technical lens. Nevertheless, the dissemination of modernism in architecture can be understood as a socially constructed process shaped by three major trajectories. The first involved professional collaborations between Western and local architects that embedded modernist ideas directly in design and construction (Lima, 2014; Kapur, 1998). The second was institutional, through organisations such as the *Congrès Internationaux d'Architecture Moderne* (1928–1959) and the Modern Architectural Research Group (1933–1957), which standardised modernist principles across scales of design and planning (Frampton, 1970; Roux, 2004; Uduku, 2006). The third consisted of political-economic exchanges among non-Western nations, exemplified by the People's Republic of China's technical assistance to Africa and Latin America since the 1950s (Chang & Xue, 2019; Ding & Xue, 2015; Sun, 2023). In contrast, Indonesia's architectural modernisation was propelled by internally driven forces rooted in its domestic political economy rather than by external professional, institutional, or geopolitical mechanisms.

Building upon this internally driven trajectory, the institutionalisation of concrete construction technology in Indonesia demonstrates how socio-technical networks consolidated across successive regimes. Spanning the Guided Democracy and early New Order periods (1959–1981), this process unfolded as a continuous yet rapid transition shaped by the 1966 political shift and the subsequent five-year development plans initiated in 1969. Rather than arising abruptly from changing socio-economic conditions, the discourse on appropriate technology evolved gradually, underscoring the need to situate institutionalisation within the distinct temporal dynamics of both regimes.

The Institutionalisation of Concrete Construction Technology in Architecture during the Guided Democracy (Old Order) Era (1959–1966).

The Economic Context.

The institutionalisation of concrete construction technology during the Old Order was inseparable from Indonesia's fragile postcolonial economy and the complexities of decolonisation under Sukarno's leadership. This economic fragility not only delineated the nation's developmental constraints but also prompted the externalisation of technological rationality as an instrument of national autonomy. Emerging from the economic and political repercussions of the 1949 Round Table Conference, the early discourse on industrial self-reliance became intertwined with the search for appropriate construction technology. Three controversial provisions of the agreement subsequently constrained Indonesia's economy: the unresolved status of Papua, the obligation to assume Dutch East Indies debts totalling US$1.13 billion at 3% interest, and the guarantee of continued Dutch business operations within Indonesia

(Siahaan, 2000; Thee, 2012). Collectively, these conditions curtailed the state's fiscal capacity and industrial autonomy, shaping the early developmental context in which concrete construction technology began to be institutionalised.

The Round Table Conference Agreement left Indonesia's economy largely under foreign control, posing major obstacles for the new government. Dutch corporations and East Asian business communities continued to dominate key sectors, from agriculture and mining to manufacturing and trade, thereby limiting Indonesians' participation in productive enterprises (Siahaan, 2000; Al-Rahab, 2014). Monetary policy was also constrained, as *De Javasche Bank*, the colonial-era circulation bank, remained under Dutch authority until its nationalisation on July 1, 1953. Before this transfer, the bank primarily served Dutch economic interests, including profit repatriation (Thee, 2012). These structural continuities of colonial capitalism undermined Indonesia's fiscal sovereignty, further complicating the state's capacity to direct industrial and technological modernisation.

The dominance of foreign corporations and entrepreneurs across Indonesia's economy in the 1950s extended deeply into the construction sector, where local professionals faced structural barriers inherited from the colonial economy. Roosseno (1908–1996)–engineer, academic, bureaucrat, and later celebrated as the "Father of Indonesian Concrete"–became a critical observer of this continuity. His testimony reveals how post-independence construction practices remained stratified along colonial social lines: Dutch elites controlled the upper tier, Chinese Indonesians occupied the middle, and native Indonesians remained confined to the lowest stratum. This hierarchy curtailed indigenous participation in architectural planning and hindered the formation of a national technological agency. Roosseno (1974, p. 23) described the situation at that time as follows:

> The planning sector was in an even worse state. Major projects were monopolised by Dutch engineering and architectural firms such as *Bureau Ingenegeren-Vrijburg* and *NV. Architecten-Ingenieursbureau Fermont en Ed. Cuypers*. At the middle level operated a few local bureaus, including Liem Bwan Tjie's office in Semarang. Only one indigenous firm existed–the Sukarno-Roosseno engineering bureau in Banceuy, Bandung–whose commissions were limited to drawings for houses, offices, and prayer rooms for Indonesian clients and friends.

During the latter half of the Guided Democracy era (1959–1966), the cement industry became a strategic sector closely tied to the institutionalisation of concrete construction technology. Despite persistent political and economic instability, this industry emerged as one of the few capable of supporting the state's externalisation of technological self-reliance, linking material production to ideological autonomy. Indonesia's first cement plant, the Indarung Factory in Padang–a colonial legacy–was nationalised in 1957, yet its planned expansion under Sukarno's administration was never realised (Zed, Chaniago, & Jasmi, 2001). The country's second plant, NV. Pabrik Semen Gresik, was inaugurated in 1957 and expanded rapidly with technical assistance

from the American firm Morrison Knudsen International Co. Inc. Although these two plants marked the foundation of Indonesia's cement industry, domestic production still met only about 36% of national demand by the early 1960s (Siahaan, 2000). To reduce dependence on imports, the government launched an ambitious plan to construct new cement factories across the archipelago, financed partly through socialist and Western bloc aid. However, most projects stalled due to financial and political turbulence, with only PT. Semen Tonasa materialising by 1967. Consequently, limited cement supply hindered the institutional consolidation of concrete construction during the Sukarno era.

Mobilising Technology for Development during the Old Order Era.

Sukarno (1901–1970) recognised the inseparable relationship between Indonesia's political and economic challenges and sought to address them through an integration of ideology, governance, and technological vision. His Presidential Decree of July 5, 1959, which reinstated the presidential system and introduced the principles of Guided Democracy and Guided Economy, reflected not only a political reconfiguration but also the externalisation of a techno-nationalist worldview in which technological advancement embodied the state's developmental will.

Beginning with his honorary Doctorate in Law acceptance speech at Gadjah Mada University on September 19, 1951, Sukarno articulated national self-reliance as the intellectual foundation of development (Sukarno, 1986). He framed the practical application of knowledge as an ethical duty to transform science into collective welfare, positioning technological utilisation as central to the nation's emancipatory project. This vision of science and technology as instruments of self-determination recurred throughout his subsequent honorary addresses, forming a consistent epistemic trajectory in his discourse on modern nationhood.

In his September 13, 1962 speech "*Engineering Science Must Serve a Just and Prosperous Society*" upon receiving an honorary doctorate from the Bandung Institute of Technology, Sukarno urged the practical application of knowledge to serve social welfare (Sukarno, 1986, p. 21). This statement was not merely an ethical exhortation but a discursive externalisation of technology as praxis–framing engineering as a moral and creative act grounded in the nation's material conditions. Although he did not explicitly invoke the notion of *techne* or technology, his articulation of engineering as both practical mastery and moral instrument resonates with the classical conception of *techne*. When extended toward innovation and collective welfare, this conception anticipated the modern understanding of technology as the transformative realisation of *techne* in social praxis.

Another part of Sukarno's 1962 speech emphasised that technological knowledge fostering prosperity must arise from self-reliant intellectual effort rooted in Indonesia's material and social realities, framing authenticity as both reflection and invention. Far from rhetorical idealism amid economic instability, Sukarno's appeal targeted the

mental development necessary for creative praxis. Although he did not employ the term bricolage–Lévi-Strauss's (1962) concept describing how inventors or engineers transform available means into novel configurations (Johnson, 2012, p. 368)–his vision resonated with its logic: technology as a constructive rearticulation of the given toward innovation. Sukarno (1986, pp. 23–24) expressed it as follows:

> Similarly, my friends, I say, if we truly want to become a great nation, strong, prosperous, safe, peaceful, just, and wealthy, in which there is no *exploitation de l'homme par l'homme*, we must seek by ourselves. And in this search, number one, as I have said earlier, is creation, ideas. Once we have that creation, we look for technical means, science, to realise this idea."

In the same address, Sukarno's reflections on concrete technology exemplified this externalisation of authentic reasoning in material practice. Recalling his studies at the Technische Hogeschool Bandoeng (1921–1926), he critiqued his professor's prohibition against concrete spans exceeding twenty metres–a rule derived from European climatic assumptions (Sukarno, 1986, p. 27). By reframing this constraint through Indonesia's stable temperature range, Sukarno redefined the epistemic authority of colonial engineering, transforming local rationality into a national technological consciousness.

Concrete was not a novel construction technology in Indonesia at the time, yet its application lacked innovation. The Netherlands did not lead in concrete development around the turn of the 20th century, as its use remained confined to civil engineering projects (Heinemann, 2013, p. 42). Although concrete was employed in public buildings, it was often concealed behind arcades and load-bearing walls, in accordance with tropical design principles (Meijling, 1953; Norbruis, 2020; Sumalyo, 2021). Early 20th-century architectural preferences still prioritised historical stylistic standards over the structural potentials of concrete (Roosmalen, 2008).

Roosseno was among the earliest advocates of reinforced concrete in the Dutch East Indies. In his 1940 article "*Het gewapend beton in den bruggenbouw in Indië*" (*De Ingenieur in Ned. Indië*, no. 8, pp. I.143–I.155), he argued that despite higher initial foundation costs, reinforced concrete offered superior durability and lower maintenance compared to timber or steel (Wangsadinata, 2008, pp. 68–69). Drawing on his experience in the *Department van Burgelijke Openbare Werke* (Department of Public Works) (1935–1943), Roosseno further underscored the economic and social potential of using locally available materials–cement, sand, crushed stone, and timber for formwork–to advance community welfare and technological self-sufficiency (Salam, 1987).

Roosseno played a pivotal role in institutionalising concrete construction knowledge in Indonesia. He sustained its teaching through the Japanese occupation (1944–1945) and into the post-independence era, ensuring the continuity of engineering education amid political upheaval (Salam, 1987; Wangsadinata, 2008). Between 1950 and 1965, he founded several private universities across Java and

produced key monographs and articles on mechanics and reinforced concrete. As both scholar and practitioner involved in major architectural works of the Old Order, Roosseno acted as a knowledge broker who translated colonial engineering principles into a modern national epistemology. Through this dual role, concrete engineering evolved from a technical craft into a systematic and autonomous field of national expertise.

Objectifying Concrete Construction Technology in Indonesian Architecture during the Old Order Era.

The objectivation of reinforced concrete technology during the Old Order marked the translation of Sukarno's ideological and pedagogical vision into institutional and material form. Long before 1959, he had laid the groundwork for this transformation by framing technological advancement as both civic education and a vehicle for national development.

Sukarno's inauguration of the Architecture Department at the Bandung Institute of Technology (ITB) on October 24, 1950 marked a decisive institutional moment in shaping Indonesia's architectural modernity (Atmadi, 1997; Hutahean, 2021; Saidi & Warsidi, 2021). Prior to this, architectural instruction existed only as a subdivision within civil engineering, a colonial legacy of the *Technische Hogeschool Bandoeng* founded in 1920. The formal establishment of architecture as an autonomous discipline not only redefined the epistemic boundaries between design and engineering but also positioned ITB as the nucleus for architectural education nationwide, as most subsequent schools were founded by its alumni.

Following the preparation of architectural professionals, the institutional consolidation of the construction sector became imperative. This process was accelerated by deteriorating Indonesia-Netherlands relations, culminating in the nationalisation of Dutch enterprises in 1959 (Siahaan, 2000; Thee, 2012). Government Regulation No. 2/1960 enabled the state to assume control over all Dutch-owned architectural and construction firms, facilitating the transfer of managerial expertise and technological competence, particularly in reinforced concrete. Notably, *De Kondor NV.* and *Naamloze Vennootschap Hollandsche Beton Maatschappij*, each with more than half a century of experience, became instrumental in embedding advanced concrete practices within Indonesia's public works. Yet, the establishment of NV. Pembangunan Perumahan in 1953 as a subsidiary of the state-owned *Bank Industri Niaga* demonstrates that the state's effort to indigenise the construction industry had already begun prior to nationalisation (Konstruksi, 1979b, p. 29).

Sukarno's final modernisation initiative materialised through large-scale construction projects that operated beyond the scope of the Guided National Development Plan. These state-led works pursued not economic rationality but the symbolic construction of national sovereignty, Nation Character Building. Financed largely through foreign loans and Japanese war reparations (Pasaribu, 2014; Sopandi,

2017a), they functioned as experimental arenas where reinforced concrete technologies were transferred, adapted, and institutionalised. Thus, these projects embodied both a political performance of independence and a techno-material process of nation-building during the Old Order.

Within this framework, the Nation Character Building programme materialised through two principal typologies of reinforced-concrete construction. The first comprised high-rise buildings, hotels, department stores, and office towers, that marked Indonesia's entry into vertical construction. The Hotel Indonesia (1959), designed by American architect Abel Sorensen, pioneered this transition. Its 14-storey reinforced concrete frame with shear walls along the broad façades introduced modern construction methods and spatial standards unprecedented in the country (Kwee, 2002, p. 121). Although structurally modest, it became the prototype for subsequent locally designed projects, the Bali Beach (1962), Samudera Beach (1962), and Ambarukmo Palace Hotels (1963), signifying the early localisation of high-rise concrete technology.

The second typology comprised long-span concrete structures, epitomised by the Sports Complex built for the 4th Asian Games in 1962. Initiated in 1959 and realised through Soviet technical assistance, the project introduced Indonesia to advanced structural engineering concepts such as the ultimate strength theory and the ring-beam system, applied for the first time in the country (Direktorat Sejarah, 2018). Beyond meeting the event's infrastructural demands, the complex served as a pedagogical site where reinforced concrete design shifted from empirical practice toward a scientifically modelled understanding of structural behaviour.

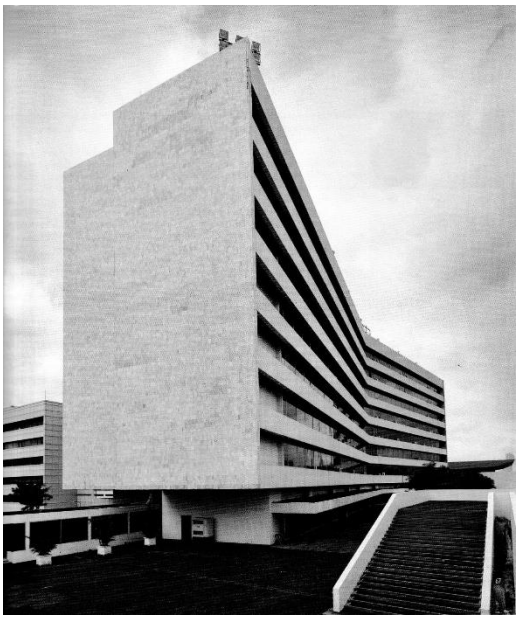
The Conference of New Emerging Forces (Conefo) complex, initiated in March 1965, represented the apex of Sukarno's Nation Character Building policy and the culmination of Old Order experimentation with reinforced concrete. Designed by Soejoedi Wirjoatmodjo (1928–1981), a graduate of the Bandung Institute of Technology and *Technische Universität* Berlin, the project advanced long-span construction through a synthesis of architectural form and structural innovation. Its main assembly hall (fig. 1a) employed a prestressed concrete shell supported by paired 120-metre arch beams, designed under the Ultimate Strength Theory introduced from Soviet engineering (Sukada, 2011; Syatria, 1995; Varia, 1965). By integrating modern analytical calculation with expressive structural form, Conefo transformed concrete into both a material and symbolic medium of technological sovereignty, positioning Indonesia within the global discourse of modern construction.

The adjoining banquet and secretariat buildings further extended this rationality into everyday structural practice. The banquet hall's 15-metre column spacing and 7.5-metre cantilevers (Fig. 1b), along with the secretariat's 11-storey frame spanning 7–10 metres, demonstrated a new confidence in the plastic behaviour of reinforced concrete (Fig. 1c). Under Soetami's direction, structural analyses adopted a limit-state approach that redefined engineering pedagogy from empirical calculation to analytical reasoning. As observed by Wiratman Wangsadinata, this shift signified not merely

technical progress but the internalisation of scientific modernity within Indonesian civil engineering (Syatria, 1995; Varia, 1965; Akmal & Faiz, 2010).

(a) main assembly hall

(b) banquet hall



(c) secretariat building

Figure 1. The Conference of New Emerging Forces (Conefo) complex, now the Indonesian parliament building (sources: (1a) photograph by Davidelit, https://commons.wikimedia.org/wiki/File:MPRDPRBuilding.jpg; (1b-c) (Sukada, 2011, p. 65, 74–75).

Soejoedi extended the technological rationality of the Conefo complex by translating the Bauhaus *Ein Einheit: Kultur und Techniek* principle–the unity of art, technology, and social harmony–into an Indonesian context (Bredendieck, 1962; Smith, 1987). His design philosophy sought not only formal ingenuity but also constructability through collective labour. The shell of the main assembly hall, though conceptually and structurally advanced, was executed through a simplified Cartesian formwork that allowed unskilled workers to pour and cast the concrete with precision. Likewise, the Secretariat façade, composed of repetitive horisontal modules, enabled efficient production without artisanal specialisation. Through these strategies, Soejoedi transformed modernist aesthetics into a labour technology: the rationalisation of construction as a social process. By delineating the boundary between professional design and manual execution, he materialised Sukarno's ideal of a technology that rejects *l'exploitation de l'homme par l'homme*, a synthesis of technological modernity and human emancipation. In this culmination, concrete construction was fully objectified as both the medium and message of national modernity–an institutional reality through which the state's developmental imagination attained material permanence.

The Institutionalisation of Concrete Construction Technology in Architecture during the New Order Era (1966–1981).

The Economic Context.

As in the preceding regime, the institutionalisation of concrete construction technology during the New Order was inseparable from its economic foundations. Unlike the Old Order's ideologically driven developmentalism, however, the New Order's economic framework was grounded in technocratic rationality that subordinated political vision to managerial control. In this context, technology became explicitly instrumental to the state's macroeconomic strategy. Between 1966 and 1981, Indonesia underwent a dramatic economic reconfiguration: initial stabilisation policies gave way to rapid growth following the 1973 oil price surge, producing sharp fluctuations in development expenditure (Hill, 2001, pp. 65–67). These oscillations compelled the state to consolidate construction as a developmental apparatus, aligning technological standardisation, fiscal planning, and labour absorption into a unified framework of state-led modernisation. Despite fiscal volatility, the New Order sustained a consistent commitment to growth-oriented infrastructure, positioning concrete construction technology not merely as a technical medium but as a stabilising instrument of economic governance.

The New Order government adopted a dual strategy to stabilise and expand the post-crisis economy (Paauw, 1963, in Booth & McCawley, 1985), combining fiscal discipline with foreign capital liberalisation as instruments of controlled growth. Unlike the Old Order, which failed to institutionalise these mechanisms, the New Order translated them into an integrated technocratic apparatus. Policy formulation was delegated to university-trained economists who organised development within a two-tier framework: long-term plans of 20–25 years and short-term Five-Year Development Plans (REPELITA), first launched in 1969. Guided by the Broad Outlines of State Policy (GBHN), the New Order prioritised the fulfilment of basic human needs as a corrective to colonial economic disparities and the politicised growth agenda of the preceding regime (Indonesia, 1968, p. 11). Grounded in economic rationality and administrative discipline, the government embedded technology–particularly reinforced concrete construction–not only as an infrastructural instrument and a symbol of technocratic order but also as a medium of calculative governance, through which architectural practice was redefined as a function of developmental planning.

During the early New Order, economic policy and technological institutionalisation were tightly interwoven. In the First Five-Year Development Plan (REPELITA I), the state prioritised basic needs–food, clothing, shelter, employment, and spiritual welfare–through the optimal use of domestic resources (Indonesia, 1968, p. 16). Agriculture served as the developmental nucleus, yet its advancement depended on the parallel growth of supportive industries such as fertiliser, cement, and chemicals. Among these, cement manufacturing was regarded as particularly strategic, linking

agricultural productivity with infrastructural expansion in dams, irrigation, and roads. The Second Plan (REPELITA II, 1974–1979) retained agriculture as a central concern but reframed economic growth as the nation's primary objective (Indonesia, 1974, p. 24). By prioritising productivity in agriculture, mining, transportation, and construction (Indonesia, 1974, p. 46), it reoriented the developmental logic from agrarian reinforcement to infrastructural modernisation–marking the construction sector's rise as a principal instrument of national progress. Through these policy shifts, reinforced concrete emerged as both infrastructural medium and epistemic apparatus, the material locus where the state's developmental rationality was externalised into built form. This constitutive ambiguity–between imported technocratic rationality and the local pursuit of technological authenticity–defined the New Order's modernisation project and underpinned the institutionalisation of concrete construction technology in Indonesia.

Indonesia's economy expanded rapidly under the New Order, sustaining one of the strongest growth trajectories in Southeast Asia despite recessions in 1975 and 1983 (Lewis, 2007; Sjahrir, 1990; Zanden & Marks, 2012). Between 1969 and 1982, GDP grew by about 8% annually (Liddle, 1991, p. 403), driven in part by the construction sector's strategic role in state-led development. Construction consistently contributed around 4% to real GDP and maintained an average annual growth rate of 8.3% between 1967 and 1981 (Fig. 2), revealing its structural importance within Indonesia's industrialisation framework and its function as a mechanism translating policy into infrastructural modernisation. This quantitative expansion mirrored the institutional consolidation of concrete technology as a material expression of the state's developmental order.

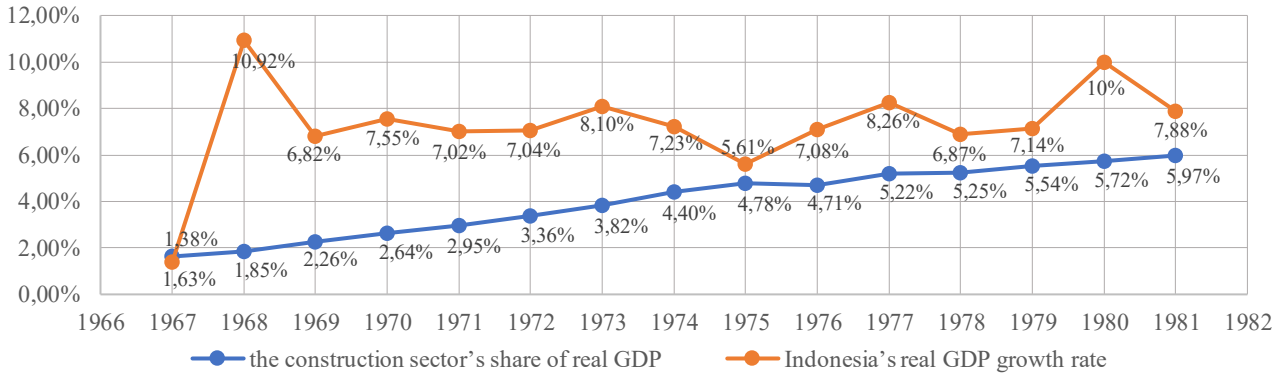


Figure 2. Indonesia's Real GDP Growth and the Construction Sector's Share of Real GDP, 1967–1981 (sources: Statistical Yearbook of Indonesia 1968–1982).

Initially positioned as an auxiliary industry to agriculture, cement manufacturing was subject to conservative production targets. During REPELITA I (1969–1974) through the early years of REPELITA III (1979–1981), government planning projected only a 24% increase in national capacity, equivalent to an annual growth rate of less

than 2%. Actual expansion, however, far exceeded projections, reaching over 30% with an average annual growth rate of 25%. The commissioning of PT. Semen Tonasa in 1971, followed by the joint establishment of PT. Semen Baturaja by PT. Semen Padang and PT Semen Gresik in 1974, and the founding of the private PT. Distinct Indo Cement Enterprise (DICE) in Citereup in 1975, reflected progressive diversification in ownership and regional distribution. Although domestic output had met internal demand, selective imports continued under bilateral trade arrangements until 1976, when national production first surpassed imports. By 1979, Indonesia achieved self-sufficiency and entered the export market, marking the redefinition of cement from a supporting industry to a driver of national industrial capability. This industrial maturation embodied the objectivation of technological capacity–cement no longer functioned merely as a resource but as a manifestation of state rationality and industrial self-reliance.

Despite endorsing industrial intensification and extensification, the government's development policy maintained a paradoxical position by restricting technological advancement largely to the educational sphere (Indonesia, 1968, pp. 49–50). Rather than promoting applied innovation within emerging industries, technology was construed as a cognitive and pedagogical pursuit, justified by the perception that Indonesian society was not yet predisposed toward technological utilisation. This rationale reflected structural realities: in the early 1960s, agriculture employed 73% of the labour force in 1961 and 65.8% in 1971 (Hill, 2001), while educational attainment remained low, on the eve of REPELITA I, 76% of Jakarta's labour force and 72.7% in other urban centers had completed only primary education or less (Booth & Sundrum, 1985). These demographic and educational constraints explain the state's cautious stance toward integrating technology into industrial practice, situating it within a discourse of developmental pragmatism rather than industrial modernity.

Development Policies and the Discourse on Technology in the New Order Era.

During the First Five-Year Development Plan (REPELITA I), technology was positioned within two interlinked domains–education -labour and research-statistics–as instruments of developmental rationalisation. It was expected to foster a rational and democratic social consciousness (Indonesia, 1968, p. 18). At the same time, the government sought to strengthen the nation's weak scientific capacity through institutional rehabilitation, human resource development, and improved access to technical infrastructure (Indonesia, 1968, pp. 131–132). These initiatives marked the embryonic stage of Indonesia's technoscientific institutionalisation. Here, technology was no longer conceived as an ethical vocation, as in the Old Order, but as a cognitive mechanism for social rationalisation.

Under the Second Plan (REPELITA II), this orientation matured into a coherent science and technology policy framework. Technology was redefined as the

application of scientific knowledge to national development (Indonesia, 1974, p. 188). Its coordination between state agencies and universities directed research toward key productive sectors–agriculture, mining, and industry–through objectives of job creation, labour productivity, and domestic tool utilisation (Indonesia, 1974, p. 194, 196). By this stage, technology had become an institutionalised driver of socio-economic transformation, embedding scientific rationality within the technocratic apparatus of the state.

Although each Five-Year Development Plan articulated systematic strategies for technological advancement, the government never clearly defined the conceptual meaning of "technology." This ambiguity arose from the normative criteria guiding its development, alignment with fiscal capacity, suitability to national conditions, and reliance on domestic materials, which collectively functioned as pragmatic filters for selecting and adapting foreign technologies while fostering limited indigenous innovation. Between 1972 and 1981, this conceptual indeterminacy generated sustained debate among bureaucrats, academics, and professionals, reflecting a broader epistemic struggle to reconcile imported technological rationality with the imperatives of national development. This indeterminacy was not merely semantic but epistemic, reflecting the unresolved tension between imported rationality and the local search for technological authenticity.

From these debates, at least three technological paradigms emerged. The first stressed the alignment of technology with ecological conditions and the everyday realities of its users. Advocating the gradual refinement of existing technological traditions, it sought to expand societal participation in development while sustaining environmental balance and utilising local resources. This approach, later termed ***teknologi madya*** (intermediate technology), was shaped by E. F. Schumacher's human-centered vision of technology articulated in his 1971 lecture at the Teilhard Centre for the Future of Man and popularized through *Small is Beautiful: A Study of Economics as if People Mattered* (1973). Schumacher's ethical emphasis on inclusive and context-sensitive development found particular resonance among Indonesian academics, who regarded it as a normative counterpoint to industrial models of technological modernisation.

In 1972, economist Sarbini Sumawinata (1918–2007) articulated a humanistic conception of development aimed at securing safety and well-being while integrating both material and immaterial dimensions of life. Acknowledging Indonesia's predominantly agrarian economy and traditional labour practices, he argued for a gradualist trajectory that balanced democratic aspirations for rapid progress with the population's technological readiness. To mediate these tensions, Sumawinata proposed intermediate technology as an equitable mode of modernisation–one enabling broad social participation without alienating users from unfamiliar work practices (Sumawinata, 1972, p. 12–13). Far from a mere revival of traditional tools, this

paradigm represented the initial modernisation of vernacular systems, fostering a transformative disposition toward sustained, human-centered development.

In 1976, economist and statesman Sumitro Djojohadikusumo (1917–2001) refined the notion of intermediate technology into a more pragmatic framework rooted in economic rationality and environmental prudence (Djojohadikusumo, 1976). He argued that Indonesia's industrial policy should prioritise employment creation, the utilisation of domestic materials, and the protection of the balance of payments (Djojohadikoesoemo, 1976, p. 78). Defining appropriate or intermediate technology as adaptive technology, Sumitro proposed the selective assimilation of innovations from advanced economies through contextual reconfiguration to local socio-economic conditions. This process, he maintained, required ecological sensitivity, as sustainable resource use became integral to technological adaptation. Although epistemically distinct from earlier humanistic interpretations, Sumitro's conception retained a normative commitment to the human dimension as the ultimate measure of technological development.

As state planning deepened, this humanistic orientation gradually yielded to a bureaucratic interpretation of technology. The second technological paradigm, ***teknologi tepat guna*** (appropriate technology), evolved from the notion of intermediate technology but assumed a more instrumental orientation. While both share a concern for contextual adaptation, appropriate technology emphasised economic feasibility, functional utility, labour absorption, and the use of local materials–priorities often dictated by bureaucratic or project-specific agendas. In contrast to the holistic and ethical vision of intermediate technology, it became a pragmatic framework in which certain values were selectively amplified according to institutional and policy imperatives.

In Indonesian architectural discourse, appropriate technology was frequently conflated with existing technology, emphasising pragmatic adaptation over innovation. Among construction professionals, this view grounded technological validity in local material availability and technical feasibility. Hartono Purbosaputro (1931–?), for instance, identified reinforced concrete as Indonesia's most suitable construction technology due to the accessibility and workability of its raw materials (Purbosaputro, 1979, p. 83). Similarly, civil engineer Sedijatmo (1909–1984) regarded his invention, the floorplate foundation, as an exemplar of appropriate technology, precisely because it relied on locally available resources and the competencies of domestic labour (Konstruksi, 1979a, p. 7). Extending this pragmatism into architectural theory, Adhi Moersid (1937–2019), national architect, defined appropriate architecture as the synthesis of functional efficiency and human adaptability, where form arises from performative logic and the capacity for transformation (Moersid, 1983, p. 35). Collectively, these positions reoriented technological discourse from innovation as invention toward innovation as contextual optimisation.

The concept of teknologi tepat guna (appropriate technology) entered Indonesia's formal development agenda in REPELITA III (1979–1984), reflecting Djojohadikoesoemo's earlier assertion that technology must be economically viable, environmentally appropriate, and socially inclusive. Initially rooted in grassroots and intellectual discourse, it was institutionalised as an adaptive form of advanced technology suited to local resources and community capacities (Indonesia, 1979, p. 56). Expanding prior aspirations from REPELITA II, the state framed it as a strategic model for equitable, context-sensitive modernisation across basic needs, resource management, industrial, defense, and socio-cultural sectors. Through this translation, the ethical language of intermediate technology was transformed into an administrative logic of appropriate technology–marking the objectivation of technological rationality within the developmental state.

The discourse on technology culminated in the articulation of a value-added technology paradigm introduced by B. J. Habibie (1936–2019), then Minister of Research and Technology. Habibie conceived technology as an instrument for enhancing added value while minimising incremental costs (Konstruksi, 1978, p. 6). He defined it as an appropriate and adequate solution, contextually embedded yet functionally efficient (Habibie, 1995, p. 21). Distinct from the moderate ethos of intermediate technology, his notion emphasised technologically advanced processes capable of transforming identical materials into higher-performance outputs through refined engineering. To realise this, Habibie underscored research on end-stage technologies and the strategic integration of technological innovation with economic policy (Habibie, 1995, pp. 73–74). Ultimately, his paradigm reframed appropriate technology as an instrument of industrial modernisation, privileging systemic innovation over incremental adaptation. In doing so, Habibie's paradigm completed the institutionalisation cycle of technological discourse: from moral reasoning and contextual adaptation to industrial instrumentalism and systemic innovation.

Objectifying Concrete Construction Technology in Indonesian Architecture during the New Order Era.

The proliferation of state-driven building projects during the New Order's developmental surge embodied the regime's projection of construction success while redefining the objectivation of reinforced concrete technology. In the recovery phase (1966–1972), the government prioritised completing unfinished projects from the previous regime–such as the Parliament Complex, Istiqlal Mosque, and the National Monument–thereby consolidating modern construction practices through relative professional autonomy. However, during the oil price surge (1973–1981), as the state assumed multiple roles as investor, initiator, and regulator, technocratic control progressively curtailed such autonomy. From 1979 onward, tighter regulations emphasising efficiency, transparency, domestic material use, labour absorption, and professional expertise culminated in the 1981 height restriction on public buildings.

This regulatory shift marked the end of monumental state projects and redirected architectural production toward functional public facilities and an increasingly privatised construction sector driven by domestic and foreign investment.

The advancement of concrete construction technology during the early New Order was driven by three key initiatives: establishing national standards, supervising construction practices, and promoting concrete as the core material of national development. The initiative was first led by Roosseno and later carried forward by his students in key institutional positions. This generational continuity reveals the operation of epistemic patronage within Indonesia's civil engineering community. Such networks operated as both conduits of technical knowledge and socio-political instruments for institutionalising reinforced concrete. Consequently, the New Order's technological modernity emerged not solely from formal state apparatuses but from a hybrid governance model grounded in expertise and inherited authority.

The codification of reinforced concrete standards marked a decisive stage in the objectivation of technological rationality, transforming engineering knowledge into an institutionalised framework of governance. When the Department of Public Works and Power issued the Indonesian Reinforced Concrete Code (PBI 1971) on October 1, 1971, chaired by Wiratman Wangsadinata, it was conceived not merely as a revision of PBI 1955 but as an effort to formalize national expertise while aligning with international norms. The drafting committee selectively adapted references from FIP-CEB 1970 (France), ACI 318-70 (US), the Unified British Standard Codes (1970), and the draft *Voorschriften Beton* (VB 1974) (Dutch), translating them into standards suited to Indonesia's material conditions and construction practices. Through this process, the epistemic authority of global engineering was domesticated into a national normative system. The code introduced elastic and ultimate strength design methods, seismic provisions, and specifications based on characteristic compressive strength, though it did not yet include rules for prestressed concrete (Yustono, 1989, p. 11). As a result, reinforced concrete technology was no longer a matter of professional discretion but a codified expression of state-endorsed modernity.

The issuance of this guideline marked an early stage in the institutional diffusion of concrete construction knowledge in Indonesia. Its practical orientation reflected the committee's intent to transform expert codification into a normative consensus applicable to everyday engineering practice. Framing this expertise within an official state document was not merely an act of legitimation, but a strategic move to reposition the state from a regulator to a mediator of technological access. Through its dissemination, the guideline consolidated existing knowledge of reinforced concrete and reinforced the institutionalisation of technological rationality within the broader agenda of national development.

During the early New Order, construction activities were heavily centralised in Java–particularly Jakarta–producing spatial disparities yet enabling the concentration of expertise necessary for the institutionalisation of reinforced concrete technology.

The capital's density of state and private projects facilitated not only the consolidation of technical standards but also their spatial embodiment within a unified regulatory framework. High-rise construction expanded rapidly during the First Five-Year Development Plan (REPELITA I) (Zoelverdi, 1974). In response, the Jakarta Provincial Government established the Building Construction Advisory Team (TPKB) on June 30, 1972 to oversee structural assessment and permit issuance under PBI 1971 (Wangsadinata, 1992, p. 21). Chaired by Roosseno with Wiratman Wangsadinata as vice-chair (1972–1982), TPKB filtered foreign projects that lacked collaboration with local professionals. Its subsequent merger with the Architectural and Urban Advisory Team (TPAK) created an integrated system of professional oversight that transformed Jakarta into a spatial apparatus of technological governance. This institutional configuration reinforced the authority of the concrete code and positioned the capital as a national laboratory for the objectivation of modern building technology.

Ambivalence in the use of reinforced concrete during the New Order was most evident in architecture, where its democratisation expanded the field of design participation yet generated epistemic tension within professional reasoning. Three overlapping paradigms–intermediate, appropriate, and value-added technology–embodied competing logics of practice: the first drew on local traditions and climatic adaptation; the second aligned technical efficiency with the state's developmental agenda; and the third pursued structural sophistication and economic optimisation. Despite their shared reliance on concrete, these frameworks produced limited innovation, as the pursuit of modernity became constrained by technical standardisation, bureaucratic procedures, and socio-economic uncertainty.

These technological modes evolved not in a linear sequence but concurrently across public architecture of varying scales, reflecting the heterogeneous conditions of state-led development. Rather than being shaped by abstract discourse, architectural practice generated its own empirical logic through everyday routines of design and construction. In the early phase of the New Order, architecture itself became a prefigurative agent of technological meaning, where the material discipline of reinforced concrete preceded and informed its conceptual articulation. Reinforced concrete thus functioned less as a differentiating marker of style than as an integrative substratum through which modern construction was institutionalised–not by discursive coherence, but through its adaptive incorporation into professional practice. This adaptive incorporation materialised in diverse architectural modes that reflected distinct technological rationalities. These variations reveal how the objectivation of concrete technology unfolded not merely through discourse, but through its physical articulation within the built environment.

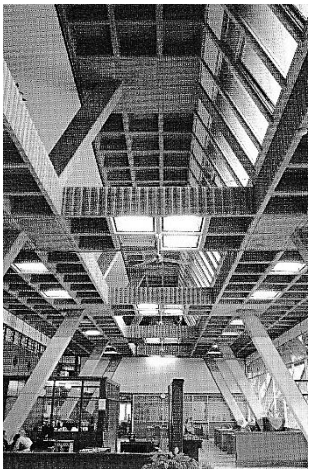
These tendencies are most evident in public low- to mid-rise buildings employing appropriate (*madya*) concrete technology. Such works reveal a synthesis of modern construction and vernacular sensibility, emphasising tropical climatic adaptation. This is particularly expressed in building envelopes where traditional roof typologies are

reinterpreted and façades integrated with the structural grid of columns and beams (Fig. 3a). Climatic responsiveness is reinforced through horisontally cantilevered concrete slabs as sunshades, porous walls for cross-ventilation, and precast concrete lattice blocks. Surfaces are finished with cement plaster, and open-frame systems with short spans predominate, reflecting a pragmatic rather than experimental structural logic.

(a) Central Kalimantan Provincial Government Office, 1978–1980

(b) PT Unilever Indonesia Office, Jakarta, 1981

(c) State Treasury Building, Denpasar, 1975–1978



(d) interior of State Treasury Building

Figure 3. Architectural works in Indonesia exemplifying three distinct technological paradigms (sources: (3a-b) (Ikatan Arsitek Indonesia, 1983, p. 49, 68); (3c-d) (Rahardjo & Soerasno, 2010, p. 110, 112).

Architectural works employing appropriate (*tepat guna*) concrete technology display significant formal diversity shaped by differing design priorities. When contextual responsiveness dominates, they resemble buildings constructed with intermediate (*madya*) concrete technology. Conversely, when efficiency, particularly the use of local materials, is prioritised, the architecture assumes simple geometric forms, open-frame structures, and painted or ceramic-clad walls (Fig. 3b). In some cases, efficiency extends to construction practicality, where large-scale components facilitate both cost management and labor absorption. Genuine appropriate technology

applications include prefabricated structural elements, floor slabs, and wall panels. Spanning varied heights and functions, these works embody not merely technical rationality but institutional adaptation to the developmental agenda of the New Order.

Architectural works employing value-added (*nilai tambah*) concrete technology foregrounded structural inventiveness as a vehicle of modernisation. Emerging during the recovery period (1966–1972), these works, shaped by the lingering ethos of Nation Character Building and the influx of foreign investment, pursued aesthetic and tectonic refinement through modified open-frame systems, long-span structures, and double-skin façades (Fig. 3c-d). By the oil price surge era (1973–1981), such experimentation became increasingly aligned with foreign architects and clients. These shifts demonstrate that architectural creativity and technological innovation were both enabled and delimited by the institutionalisation of concrete construction under state-led developmentalism.

Conclusion.

This study establishes that the modernisation of architecture in Indonesia constituted a distinct, non-Western trajectory–one materially grounded in the ongoing institutionalisation of concrete construction technology across two contrasting political regimes. Rather than emerging from stylistic transformation or epistemic rupture, it evolved through the social construction of concrete technology as both a material and institutional medium of modernisation. Drawing on Berger and Luckmann's Social Construction of Reality, the study conceptualises modernisation as a dialectical process of externalisation and objectivation, in which knowledge, practices, and material forms were continually negotiated among state authorities, professional organisations, and construction actors. In this sense, technology was not merely transferred but continually produced and legitimised as a developmental instrument within changing political contexts.

During the Old Order, technological externalisation was articulated through the rhetoric of national autonomy and scientific advancement under economic austerity. Objectivation materialised in state-sponsored monumental projects–most notably the Conefo complex–that embodied political modernisation yet remained institutionally centralised. The institutionalisation of technology during this phase was prefigurative and exclusive: architects and constructors acted as agents of state ideology rather than autonomous negotiators of technological practice, rendering modernisation more symbolic than material.

The New Order redirected this trajectory from ideological representation toward managerial and technical rationalisation. Technological externalisation shifted into professional and academic domains, where architects and engineers sought to adapt imported methods to local capacities, labour structures, and regulatory standards. Objectivation expanded through the civil engineering field, transforming supervision and standardisation–exemplified by PBI 1971 and the Jakarta TPKB–into instruments

of knowledge production. This marked a reproductive phase in the ongoing institutionalisation of concrete construction technology between 1966 and 1981, during which technological practices became increasingly integrated within bureaucratic and professional systems, though still shaped by administrative control.

By linking externalisation and objectivation to the unfolding phases of technological institutionalisation, this study advances an analytical framework for interpreting architectural modernisation as a socio-technical process rather than a stylistic evolution. It extends global historiography by demonstrating that Indonesian architectural modernity emerged through the materialisation of technology within non-Western developmental regimes. Bridging Social Construction of Reality (SCOR) and Social Construction of Technology (SCOT), this framework elucidates how material governance and actor configurations structured uneven, context-specific trajectories of modernisation. In doing so, it reconceptualises modernity as a negotiated socio- material construct–continuously sustained through technology, labour, and institutional order.

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Conflict of Interest.

The authors declare no conflict of interest.

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Бхарото Бхарото
Інститут технології Бандунга, Індонезія
Університет Діпонегоро, Індонезія

Хімасарі Ханан
Інститут технології Бандунга, Індонезія

Андрі Відіовіджантоко
Інститут технології Бандунга, Індонезія

Інституціоналізація технології бетонного будівництва: Соціотехнічне формування сучасної архітектури в Індонезії

Анотація. *Інституціоналізація технології будівництва в постколоніальній архітектурі рідко досліджується з позицій досліджень науки і технологій, особливо в країнах, що розвиваються, де процес модернізації частіше визначався політичними програмами, ніж індустріальним зростанням. Ця стаття заповнює зазначену прогалину, аналізуючи соціотехнічний процес інституціоналізації технології бетонного будівництва в індонезійській архітектурі в період з 1959 по 1981 роки. Спираючись на теорію соціального конструювання Бергера та Лукмана, зокрема на поняття екстерналізації та об'єктивації, дослідження розглядає періоди Старого порядку та Нового порядку як послідовні режими, що формували й закріплювали технологічні значення у межах власних національних наративів розвитку. У дослідженні аналізуються президентські промови, урядові політики та публікації практиків з метою простежити історичні дискурси, які пов'язували технологію з національним розвитком. Результати свідчать, що ці дискурси спочатку були різноспрямованими: Старий порядок зосереджувався на розбудові нації через монументальні проєкти, тоді як Новий порядок наголошував на соціальному добробуті через економічне зростання. Згодом ці протилежні дискурси взаємодіяли й сприяли об'єктивації бетону як домінуючого матеріалу та методу будівництва в архітектурі після здобуття незалежності. Розрив у розвитку під час Старого порядку (1959–1966) породив модерність, що виникла з економічних обмежень, але вирізнялася інноваційністю через безпрецедентне використання бетону. Натомість період Нового порядку (1966–1981) характеризувався модерністю, заснованою на ефективності, використанні місцевих матеріалів і соціальній емпатії в умовах економічного піднесення. Попри відмінності, технологія бетонного будівництва зберегла архітектурну тяглість, поєднавши обидва режими. Таким чином, процес інституціоналізації є узгодженим соціотехнічним переходом, а не лінійним поширенням сучасної технології. Індонезійський досвід робить внесок у глобальні дискусії з досліджень науки і технологій, пропонуючи Південну перспективу на те, як сучасна архітектура матеріалізується через історично та контекстуально зумовлені технологічні конструкції.*

Ключові слова: *політика розвитку; екстерналізація; індонезійська сучасна архітектура; об'єктивація; соціотехнічна інституціоналізація*

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