

Jeepney Modernization as Industrial Strategy

Technological Pathways and Industrial Upgrading in the Philippines

Honey Bermudez Tabiola 



Political Economy Program

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Telephone: (02) 8981-8500 loc. 4266 to 4268 / (02) 8426-0955

Email: cidspublications@up.edu.ph

Website: cids.up.edu.ph



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Cover Image Credit

“Two jeepney builders carefully assemble a brand-new unit at the Sarao Motors factory in Pulang Lupa, Las Piñas, Philippines.”

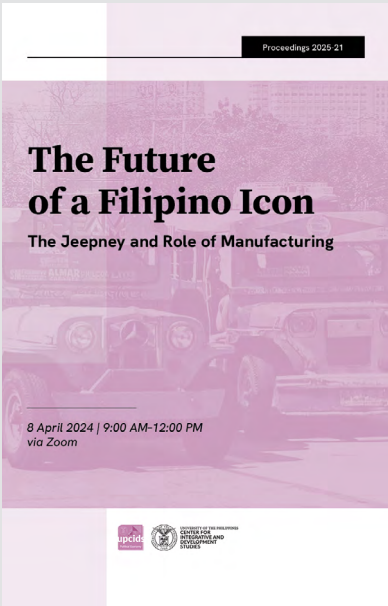
Image taken by the author on December 10, 2024

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The Future of a Filipino Icon

The Jeepney and Role of Manufacturing

8 April 2024 | 9:00 AM-12:00 PM via Zoom

UPCIDS UNIVERSITY OF THE PHILIPPINES CENTER FOR INTERNATIONAL DEVELOPMENT AND STUDIES

PROCEEDINGS

The Future of a Filipino Icon:
The Jeepney and Role of
Manufacturing



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EPIRA BEFORE AND AFTER

Jaime Veneracion¹

INTRODUCTION

The paper investigates the history of power generation, distribution, and supply of electricity. In the historical approach to the problem of electricity, it adopts a narrative that includes people, and not just abstract ideas and policy statements. While important from an institutional point of view, offices, legislative acts, and executive orders, do not explain much of the political dynamics involved.

But as Barbara Tuchman advises, the historical narrative is an attempt to put faces of persons, circumstances, places and actual events and how they actually happened, what she would describe as "vornomative details." An aim of this paper is to re-examine the actual debate and hearings in Congress in the formulation Republic Act No. 1166 or the Electric Power Industry Reform Act (EPIRA), asking who were its champions and what was its rationale? In the process of examining the proceedings, we could detect some "cracks in the parchment curtain" as William Henry Stone would put it, revealing the interaction of vested interests and the public behind the piece of legislation now under our review.

"Before the EPIRA" refers to the debates around the passage of the EPIRA. The energy crisis going on post-EDSA I Revolution took the extraordinary powers of the presidency to solve it. The legislative hearings uncovered the opposing sectors of society—particularly the business sector on the one hand represented by Raul Concepcion, which supported whatever may be needed in order to solve the brownouts, and the non-government organizations (NGOs) and progressive bloc which thought of the grant of emergency powers as conditions for the eventual declaration of Martial Law. Among those who spoke against the grant of emergency power were the religious sector; the influential The Association of Major Religious Superiors in the Philippines (AMRSFP) led by Sr. Pia Lansang, progressive NGOs, and communities where the coal-generating proposed plants would be established such as those in Calaca, Batangas, and Mantilio, Zambales.

Through compromise, emergency powers were delimited in scope. The business community did not see any problem renaming the term "emergency powers" as a condition for the passage of the law, since it needed just the assurance of the 300-megawatt power source to ensure manufacturing and commercial operations. It insisted however on the need for the reorganization of the National Power Corporation (NPC), the agency for the creation of power industry players known as Independent Power Producers (IPP). The negotiated contracts with these private power producers were supposedly transparent with the Congress having an Oversight Committee looking into the bid process.

¹ UP CIDS Research Fellow

POLICY BRIEF

EPIRA Before and After



Jeepney Modernization as Industrial Strategy

Technological Pathways and Industrial
Upgrading in the Philippines

Honey Tabiola

Highlights

- Domestic jeepney manufacturing is viable and warrants strategic state support. The paper argues that deliberate and coordinated government intervention—through institutional linkages and targeted incentives—is necessary to enable industrial upgrading. By foregrounding manufacturing, the study reframes the Public Transport Modernization Program (PTMP) not only as a transport reform issue but also as a question of national industrial development.
- Modernization involves multiple technological pathways. As an exploratory study, the paper examines the transition to electric jeepneys and less-discussed pathways, namely LPG-powered jeepney and hybrid retrofitting. Rather than privileging a single solution, the paper highlights a diversity of options that have distinct technical, economic, and environmental implications.
- The PTMP creates a window of opportunity for industrial upgrading among traditional jeepney manufacturers. While firms like Sarao Motors and Francisco Motors Corporation (FMC) are actively building their electric vehicle (EV) capabilities by acquiring and integrating advanced technologies, Tojo Motors—as an EV pioneer—illustrates an earlier domestic transition, together highlighting how local firms navigate technological learning given the challenge of jeepney modernization.
- Fragmentation constrains industrial upgrading. The sector remains characterized by weak coordination among manufacturers, suppliers, research institutions, and state agencies. Existing incentives are insufficiently integrated into a long-term industrial strategy. Jeepney manufacturing—particularly in low-emission technologies—should be treated as a strategic industry requiring coherent coordination across transport, industry, energy, and science agencies.
- Modernization must be embedded in a just transition framework. The PTMP should align environmental standards across vehicle types while prioritizing affordable, high-capacity mass transit. Jeepney reform must be situated within a broader transformation of the transport system to ensure equity, sustainability, and domestic value creation.

Introduction

In 2017, the Philippine government introduced the Public Transport Modernization Program (PTMP),¹ aimed at promoting a “reliable, safe, accessible, environmentally friendly, efficient, comfortable” public transport system. The program consists of phasing out the traditional jeepneys and replacing these with modern vehicles that meet minimum emission standards, consolidating individual operators into cooperatives or corporations, rationalizing routes to improve service, updating regulatory frameworks, and providing financial and livelihood support to ease the transition. More than a transport policy reform, the PTMP represents a structural reorganization of the jeepney sector’s institutional and technological foundations². It is this program, under the Department of Transportation (DOTr), that has recentered national attention on the jeepney—not only as a mode of transportation but also as an issue on industrial policy.

The defining and contentious feature of the PTMP is the proposed shift to modern vehicles that are powered by electricity or other cleaner forms of energy. The proposal would not only render obsolete 177,852 jeepneys currently plying the Philippine streets (LTFRB 2024). Jeepney operators and drivers are expected to shell out two to six million pesos to acquire the standard units. Moreover, of the 54 modern PUV models considered compliant with the requirements, 34 are classified as “locally manufactured or assembled,” but many of these vehicles are produced under foreign brands that designed, marketed, sold, and hold the intellectual property rights over these units (Dela Peña 2024). In this scenario, modernization risks becoming primarily a vehicle replacement program and local assembly rather than a strategic opportunity for domestic industrial upgrading.

Since such a shift would rely on the importation of electric or Euro 4-powered vehicles, the proposition raises a critical but underexamined question: what role can domestic jeepney manufacturing play in the public transportation modernization process? There has been little policy or academic analysis centered on domestic jeepney manufacturing firms. While the responses and

1 Formerly and still also known as the Public Utility Vehicle Modernization Program (PUVMP) until December 2023.

2 In this paper, a “sector” is defined as “a set of activities unified by related product groups that serve a given demand and share a common knowledge base” (Malerba 2004, as cited in Lee & Ki 2016, 2), as applied to the local jeepney manufacturing sector.

struggles of transport workers have been extensively documented in mainstream media and scholarly work (Mendoza 2021; Bendana et al. 2020; Velasco 2024; Dimalanta and Morales 2024), far less attention has been paid to the status and role of the local jeepney manufacturing sector. In particular, there is a lack of systematic analysis of how domestic firms navigate the challenges and opportunities created by the PTMP within the broader framework of national industrialization. This paper seeks to help address this gap and asks: What are the policy, technological, and social requirements to promote domestic jeepney manufacturing?

The paper argues that the PTMP should be analyzed not only as a transport reform but also as a pivotal industrial policy moment. For some jeepney manufacturing firms, the PTMP can present a rare opportunity to pursue industrial upgrading—moving from basic assembly toward more integrated manufacturing and research-and-development collaboration that could enhance local value creation and support a broader transition toward sustainable mobility.

Undertaken as an exploratory study, the paper examines a range of technological pathways so that the shift to modern and environment-friendly public utility vehicles is affordable to small jeepney operators and drivers and promotes local manufacturing. The paper will also present for discussion alternative modernization pathways toward this end—including full electrification, hybrid retrofitting of existing diesel engines, Euro 4-compliant engines, and LPG-powered variants. Drawing on document analysis and semi-structured interviews with selected experts from academia and industry, the study identifies emerging technological experimentation, including electric prototypes, alongside persistent fragmentation within the sector.

The central argument of the paper: while the PTMP creates a window of opportunity for industrial upgrading among domestic jeepney manufacturers, the sector's fragmented structure underscores the need for active, coordinated state support. Deliberate state action – in the form of policy incentives for manufacturers and users and coordinating linkages among manufacturers, universities, suppliers, and financing institutions—is necessary for industrial upgrading. At the same time, it will draw on the just transition approach, where the reforms will be participatory and accessible. By foregrounding the manufacturing dimension of jeepney modernization, this paper contributes a distinct perspective to existing debates and reframes the future of the jeepney as both a transport and an industrial development question.

PTMP's Regulatory Architecture and Industrial Implications

The PTMP involves various agencies led by the DOTr, with the Department of Environment and Natural Resources (DENR), the Department of Energy (DOE), and the Land Transportation Office (LTO). It sets new technical rules that reshape how public transport vehicles are built, financed, and operated. These rules affect not only drivers and operators who must comply with them, but also local manufacturers that must upgrade their production activities. By linking environmental standards, fuel efficiency rules, and electric vehicle policy, the PTMP creates both pressures and opportunities across the jeepney sector.

At its core, the PTMP seeks to transform public transport into a system that is safer, cleaner, and more reliable. A key provision requires the replacement of traditional jeepneys and other public utility vehicles (PUVs) with units that comply with Euro 4 emission standards or use cleaner energy sources such as liquefied petroleum gas (LPG), electric, or hybrid systems. These standards are drawn from existing regulations, particularly the DENR Administrative Order 2015-04 and its subsequent issuances, pursuant to the Clean Air Act of 1999 (Republic Act [RA] No. 8749). These mandate that new vehicles to be used and introduced into the Philippine market meet Euro 4 limits or emission standards.

All PUVs are required to use clean and energy-efficient technologies, including hybrid and electric systems or other technologies recognized in current and future DENR guidelines. This provision does three things. First, PTMP allows different technological options within a general shift toward lower emissions, specifically, those with Euro 4-compliant engines or electric motors. Second, it also calls for phasing out jeepneys that are more than 15 years old. Third, the implementation of this provision will impact the 238,472 units that are plying the streets all over the country, of which 177,852 (74.58 percent) are older than 15 years (LTFRB 2024).

It has been argued that jeepney modernization has some long-term benefits. Over time, fuel-efficient vehicles may reduce operating costs, particularly due to lower fuel consumption and, in the case of electric vehicles, potentially lower maintenance expenses. Unfortunately, in the short term, such a prospect of enjoying the long-term benefits assumes that jeepney operators and drivers can afford the shift to the modern jeepneys.

For local manufacturers and jeepney body builders, complying with Euro 4 standards and electric vehicle (EV) rules requires higher technical capability, including engine integration, battery systems, and formal testing and certification. Smaller, backyard assemblers—many of whom built their businesses around simple fabrication and reconditioned parts—may struggle to meet these new benchmarks without substantial capital investment and technical support.

“Rebuilding” of the traditional jeepney is also possible, but with conditions. “Rebuilt units” must be outfitted with Euro 4–compliant engines or electric motors. These units may also operate only where brand-new units are deemed not feasible (such as due to the lack of EV charging stations or rough terrain). For drivers and small operators, this requirement does little to resolve the high cost of compliance. Euro 4 engines and electric or hybrid systems are far more expensive than traditional diesel platforms. Although the program provides subsidies and financing schemes, the minimum technological standard favors operators with greater access to capital. The shift, therefore, increases financial risks for small operators, especially those transitioning from individually owned units to consolidated fleet models (Mendoza 2021; Dimalanta and Morales 2024).

In effect, the PTMP’s technological provisions transform modernization into a broader restructuring of the public transport industry. Environmental standards, fuel efficiency rules, and vehicle technology requirements now determine who can participate in the market. While these rules aim to promote cleaner transport, they also reshape the distribution of risks and opportunities—placing heavier pressures on small operators and low-capability assemblers, while creating conditional prospects for industrial upgrading among firms able to adapt to higher technological thresholds.

The Case for Domestic Jeepney Manufacturing and its Industrial Upgrading to Electric Mobility

This section examines the prospects and challenges of domestic manufacturing amid the country’s transition to electric and cleaner public utility vehicles. The PTMP creates a window of opportunity for industrial upgrading, prompting firms such as Sarao Motors and Francisco Motors Corporation (FMC) to build capabilities in EV production, while ToJo Motors exemplifies an earlier

domestic move into electric mobility. Together, these cases illustrate how local manufacturers are navigating technological learning under modernization pressures.

However, whether this transition strengthens the domestic industry depends on active and sustained state support. With strategic coordination, financing, and capability-building policies, the shift to electric mobility can reduce import dependence, generate employment, and catalyze broader industrial development. Without such support, rising compliance costs risk turning modernization into a process of firm exit rather than industrial upgrading.³

Knowledge Base and Technological Evolution of the Jeepney

The technological foundation of the jeepney sector is undergoing a critical transition. Traditionally, the sector has been anchored in a mature backyard manufacturing model centered on surplus internal combustion engine (ICE) technology. The availability of reconditioned secondhand imported engines lowered entry barriers for domestic assemblers. It enabled small manufacturers to serve the low-cost segment of the market and helped keep the overall price of traditional jeepneys affordable.

The PTMP disrupts this business model. Firms can either exit the sector as compliance costs rise, or treat the transition as what Lee and Malerba (2016) describe as a “window of opportunity” for industrial upgrading. In the case of jeepney manufacturing, such windows are made possible from shifts in demand toward safer, more comfortable, and environmentally sustainable transport; from emerging technologies such as electric and hydrogen powertrains; and from state-led programs like the PTMP that create new regulatory and market conditions.

The technical know-how for gasoline-driven jeepneys is already well developed. According to Architect Leonard John C. Sarao,⁴ gasoline-powered units are “built to last”: units manufactured over fifteen years ago remain in operation,

3 Industrial upgrading occurs when domestic firms acquire the capabilities to move into higher value-added activities at global levels of efficiency, while simultaneously absorbing advanced foreign technologies and incorporating increasingly sophisticated local skills (Doner et al. 2021, 1).

4 Interview with Ar. Leonard John C. Sarao (Operations Supervisor, Sarao Motors, Inc.) 10 December 2024.

and repairs can be easily carried out by informal workshops. As a result, the gasoline-driven jeepney has reached what may be described as an “innovation plateau,” characterized by limited incentives for product differentiation or technological advancement.

The price of a jeepney equipped with a Euro 4–compliant internal combustion engine is already approaching that of an electric jeepney. Because Euro 4 engines are largely imported, domestic assemblers face limited scope for technological deepening if they remain within the internal combustion engine (ICE) pathway. This cost convergence may create an opportunity for industrial upgrading. Rather than investing in incremental improvements in imported ICE technology, local firms could shift directly toward EV or hydrogen platforms, positioning themselves as late entrants in emerging clean mobility segments. Whether this leap is feasible, however, depends on access to finance, technical partnerships, and sustained policy support.

In a roundtable discussion, Mr. Elmer Francisco believes that it would be strategic for his company to pivot from diesel engines to electric jeepneys because the Euro 4 diesel engine remains a pollutant and is even rendered obsolete in many advanced countries anyway, with the developing countries may be following suit in the future (PEP UPCIDS 2025).

Meanwhile, Dr. Edwin Quiros⁵ believes that the core challenge is no longer the capability of Filipino engineers and manufacturers to design and build electric jeepneys. Rather, the decisive constraint lies in the absence of sufficient and predictable domestic demand that would allow firms to invest in electrification at scale and achieve economic viability.

Domestic Firms’ Strategies towards Developing Capabilities and Industrial Upgrading

There is a discernible growing interest among domestic firms toward EVs. While electric jeepney prototypes in the country date back as early as 1988—most notably in the case of FMC—the e-jeepney has only gained traction in recent years, particularly with the rollout of PTMP (Tribdino 2025). For Sarao Motors, Ar. Sarao mentioned that in October 2024, the company is in a partnership with Tembo E-LV in the Netherlands to “provide Sarao Motors

5 Interview with Edwin N. Quiros, PhD (Retired Professor at the Department of Mechanical Engineering, University of the Philippines Diliman), 6 December 2024.

with state-of-the-art and cost-effective solutions to electrify the next generation of public utility jeepneys” (Tembo e-LV 2024). Tembo takes care of system design and powertrain, while Sarao provides the chassis and the body of the e-jeepney. Except for the electric motor, Sarao will thus source locally, if not manufacture, most of the parts and components of the jeepney. Tembo has committed to Sarao to have an inventory of its own manufactured spare parts and “wear and tear” components of the engine and the charging infrastructure, so repairing and after-sales services will be readily available in the Philippines. For Ar. Sarao, therefore, the partnership presents a relatively cheap and efficient way to bring down the price of the e-jeepneys.

Sarao Motors is also poised to gain in terms of skills development because Tembo is committed to training Sarao’s workforce. With a local office already established in the Philippines, Tembo actively talks to transport cooperatives, corporations, and local government officials (e.g., Lucena City, Quezon) to discuss electrifying jeepneys and establishing EV-related infrastructure (Tembo e-LV 2023). While forging a joint venture with a local subsidiary of a TNC is one way for Sarao to accumulate capabilities and to move up to the higher segments of the value chain, Sarao Motors will need to explore “independent strategies to deepen their indigenous capabilities through in-house and conscientious efforts,” leveraging partnerships with other local actors⁶ in the sector outside the tight grip of the TNCs (Intarakumnerd 2021, 219).

For its part, FMC launched in April 2018 the full electric modern Francisco Jeepney (Francisco Motors Official Website 2024). FMC is set to relocate to a special economic zone (SEZ)⁷ in Camarines Norte, Bicol Region. With the SEZ, it is projected that the company can produce 25,000 units per year. The SEZ will also house its technology partners, such as NextGen NRG of Australia (for developing the hydrogen fuel cell systems) and a German electric drivetrain technology group for the electric drivetrains.

Different from the strategy of Sarao Motors, FMC relies on the company’s own manufacturing capabilities to offer cost-effective powertrains or locally

6 The engagements of Sarao Motors with the local universities do not yet involve intense R&D activities. For example, Ar. Sarao shared that university students come to Sarao Motors to conduct academic research on the business operations of the firm as a case study or use the field site of Sarao Motors to test their prototypes for their school projects.

7 In 2024, FMC was the largest investor registered with the Philippine Economic Zone Authority (PEZA) with P52B ecozone project (Mencias 2024).

manufacture them in its own plant. FMC directly acquired talent and technical knowledge from TNCs all over the world. Mr. Francisco claims that many of their engineers are from Tesla, SpaceX, and Toyota. It wants to run the whole supply chain in the Philippines, save for a few critical components which still need to be imported. He shared, “[O]ur Team has over 50 years of collective direct experience in the electric vehicle industry” (PEP UP CIDS 2025).

Considering that the average price of jeepneys based on market data is from ₱2 million to ₱2.5 million, the company believes that the key is competitive pricing of high-quality vehicles (FMC Corporate Highlights 2024). To achieve this, it is seeking to expand its market share and offer more affordable new jeepneys by 15–20 percent more than the competition. The company also seeks to leverage an “in-house financing” for customers and arrange terms that will facilitate the acquisition of jeepney operators of new jeepney units, while not adversely impacting their daily income.

In June 2025, FMC inked a deal with Space AI Nigeria Ltd. to export electric jeepneys and hydrogen fuel cell-powered tricycles to Benue State, Nigeria (Francisco Motors 2025c; Ibeh 2024). The Nigeria deployment is seen as the starting point towards exporting to 12 neighboring countries in West Africa (Tribdino 2025).

Established in 2013, ToJo Motors is a 100 percent Filipino-owned company that manufactures, assembles, develops, and distributes electric vehicles in the country, with a specialization in e-tricycle (or e-trikes) and e-jeepneys (ToJo Motors 2025). Except for a few components such as traction and controller, ToJo designs and locally produces 90 percent of the parts and components of the vehicles, including the battery module, mechanical system, electrical system, smart devices, chassis, and the body of the vehicle (SOLUTIONSplus Project 2020). It also reports having between 51 and 200 employees, having six service stations throughout the country covering warranty and service maintenance, with its vehicles operating within fourteen (14) cities and municipalities in the country. The company has two production plants in Santa Rosa City, Laguna.

Its locally-made 23-seater electric jeepney prototype (compliant with the PUVMP Class 2 category) was a collaboration among various local actors. ToJo Motors manufactured the prototype that was designed by the engineers at Electric Vehicle Association of the Philippines (EVAP), in partnership with De La Salle University, and was funded by the Department of Science and Technology–Philippine Council for Industry, Energy, and Emerging Technology Research and Development (DOST–PCIEERD). During the

demonstration run, then DOST Secretary Fortunato de la Peña called on the government and the private sector to create “creative support mechanisms,” such as financing and leasing, to attract investment in vehicle and component manufacturing (Arayata 2022). PCIEERD Executive Director Eric C. Paringit likewise noted that the technology is available for licensing to enable wider firm adoption (*SciTech & Digital News* 2023).

To enhance the initial cost affordability of the vehicle, ToJo Motors is also exploring selling the vehicle with the option of excluding the batteries with subscription to a battery leasing and/or swapping program. For Dr. Lew Andrew Tria⁸, the battery swapping model is a potential game-changer for the adoption of e-jeepneys and EVs in the country in general; it reduces the cost of electric vehicles (EVs) by separating battery ownership from the car or a jeepney and using a network of swapping stations to replace depleted batteries with fully charged ones in minutes.

Technological Pathways

Given that the full transition to electric vehicles will unfold over several years, it is important to examine alternative technological pathways in the interim. To advance cleaner and more energy-efficient transport, the PTMP mandates the adoption of alternative fuel vehicles and engines—including hybrid and electric systems, as well as other technologies recognized by the DENR. Rather than prescribing a single solution, the program allows multiple transition pathways, each with distinct technical, economic, and environmental trade-offs.

The following section outlines these alternatives, highlighting less-discussed options and the key policy considerations shaping their adoption.

LPG as an Alternative Drivetrain for Philippine Jeepneys

Promoted as a cleaner-burning fuel and an interim stepping stone toward broader transport modernization, Liquefied petroleum gas (LPG) can be deployed via either retrofitting existing engines or through purpose-built new units equipped with LPG drivetrains.

8 Interview with Engr. Lew Andrew Tria, Ph.D. (Professor and Director at Electrical and Electronics Engineering Institute, College of Engineering, UP Diliman) 12 December 2024.

One of the principal advantages of LPG is its potential to reduce harmful emissions relative to older diesel engines. LPG combustion produces lower levels of particulate matter and other toxic pollutants, which can contribute to improved urban air quality and compliance with emission standards such as Euro III (Quiros et al. 2018). Early initiatives in the 2010s showed that jeepneys fitted with LPG engines could meet Euro-III emission standards, lowering soot and smoke emissions compared with surplus diesel engines (Biona et al. 2017). In addition, LPG fuel is often less expensive per liter compared with diesel, which can, under certain pricing regimes, reduce fuel operating costs for drivers. Industry narratives from conversion efforts in the 2010s suggested that lower fuel expense could translate into annual savings for operators, potentially increasing net income (Eco-Business 2013).

Achieving meaningful adoption of LPG jeepneys requires state-coordinated action in vehicle design, fiscal support, fuel pricing policy, and infrastructure development. Framing these not as constraints but as critical considerations allows for a more constructive assessment of LPG's role within modernization.

Empirical evidence from controlled tests highlights important technical considerations that policymakers must address. On-road and laboratory tests conducted by the University of the Philippines National Center for Transportation Studies indicate that LPG-powered jeepneys cover fewer kilometers per liter of fuel compared to their diesel counterparts (Quiros et al. 2018; Quiros, Vergel, and Abaya 2017). Measured LPG mileage ranged from approximately 3.8–4.2 km per liter on urban routes while the diesel jeepney mileage was about 6.7 km per liter. This performance reflects LPG's lower energy content per liter and possible nonoptimized powertrain configurations, among others. These findings highlight opportunities to enhance the competitiveness of LPG jeepneys by improving its technical design (e.g., engine size and drivetrain components), while also underscoring the need for government action to address mileage differences through fuel pricing and other financial interventions.

Some considerations for its adoption include capital cost as a key constraint. Retrofitting diesel jeepneys to LPG costs about ₱350,000 (Biona et al. 2017), while purpose-built LPG units can exceed ₱1 million. For small operators, this underscores the need for targeted subsidies, concessional financing, or tax incentives; without these, adoption may remain limited to larger operators.

Fuel infrastructure is another challenge. The uneven distribution of LPG refueling stations—especially outside major urban centers—limits route flexibility and reliability, making network expansion crucial.

Although LPG drivetrains offer environmental gains over older diesel engines and may reduce fuel cost volatility, wider adoption depends on addressing financial and infrastructural gaps. Under the PTMP, LPG could serve as a transitional pathway where electrification remains constrained, provided policy support is strategically aligned with operator realities.

Hybridization of surplus engines with electric transmission

Retrofitting existing internal combustion engine (ICE) jeepneys with hybrid systems—meaning vehicles that use both a diesel engine and an electric motor—has been proposed as a possible intermediate option under the PTMP. In a hybrid retrofit, electric parts such as a motor, batteries, and control devices are added to the current vehicle so that the diesel engine and electric motor work together. Many hybrid systems also use regenerative braking, which captures some energy during braking and stores it in the battery.

Studies from other countries show that hybrid vehicles can use less fuel and produce fewer emissions than conventional diesel vehicles. Research on hybrid buses, which operate in ways similar to high-capacity jeepneys, reports fuel savings of about 20–35 percent⁹ in urban driving conditions with frequent stopping and starting (Hayes et al. 2006; Bottiglione et al. 2014). Emissions of carbon dioxide and other pollutants also decline. These improvements are mainly due to the electric motor assisting the engine at low speeds and during acceleration, as well as energy recovery during braking. Such findings suggest that hybrid systems could contribute to improved fuel efficiency and lower emissions under the PTMP.

In the Philippine setting, Denoga (2017) finds that different hybrid designs could meet the basic performance needs of public utility vehicles. The study stresses that any assessment should consider overall costs across the vehicle's

9 In Italy, more specifically, it has been shown “that the series hybrid-electric vehicle outperforms both the traditional and the mechanical hybrid vehicles in the simulations with the air conditioning system turned off” with fuel consumption about 35% lower than that of a traditional diesel bus and 25% lower than that of a mechanical hybrid bus (Bottiglione et al. 2014, 4218).

lifespan—including initial expenses, possible fuel savings, maintenance, battery replacement, and route conditions¹⁰. Reduced fuel use may also lessen exposure to diesel price fluctuations, which is relevant in a country that relies heavily on imported fuel¹¹. With regard to vehicle age and durability, new batteries may have a service life of five to eight years, but the remaining lifespan of an aging chassis could be substantially shorter. In an interview, Dr. Lew Andrew Tria mentioned that a mismatch in component durability could undermine the economic rationale for retrofitting, particularly if structural failure renders newly installed components unusable. As such, he suggests that eligibility criteria for retrofit programs—such as minimum structural condition standards—may be necessary if such a transition pathway is pursued.

At the same time, several important concerns need careful consideration.

Hybrid retrofitting presents a potential transitional pathway, but its viability depends on deliberate policy design. First, the government may consider targeted fiscal support to address the high upfront costs of electric motors, battery packs, and control systems, which remain a key barrier to adoption (Abdullahi and Adnan 2024; Denoga 2017). Clear cost-recovery assessments and pilot financing schemes could help determine realistic payback periods under local operating conditions. Second, given the non-standardized structure of traditional jeepneys, policymakers may also consider establishing technical standards for retrofitting, including guidelines on battery placement, structural reinforcement, suspension upgrades, cooling systems, and passenger safety. Existing research underscores ongoing improvements regarding the essential components of a hybrid vehicle, including energy storage system, engine–motor coordination, and long-term performance and reliability (Singh et al. 2019), reinforcing the need for robust quality assurance (QA), testing, and certification mechanisms prior to large-scale deployment.

Third, the government may likewise consider commissioning localized performance testing to evaluate real-world fuel savings and emissions reductions, particularly in congested urban corridors where operational conditions differ

10 One estimate indicates that a jeepney operator would need a total of Php 11,073.93 per month to convert a conventional jeepney into a hybrid vehicle, including amortized costs for initial component investments (over three years), battery replacement (over one year), and monthly fuel expenses (Denoga 2017).

11 Denoga claims that the biggest selling point for hybrid vehicles is their positive environmental impact, noting that “if 49% less fuel is burned everyday by the public transportation sector, that much less carbon dioxide is released to the atmosphere every day” (2017, 27).

markedly from laboratory settings (Bottiglione et al. 2014). Because hybrid vehicles continue to rely partly on diesel engines, emissions standards and monitoring frameworks would need to reflect their partial decarbonization profile. Finally, if hybrid retrofitting is to be integrated into the modernization framework, policymakers may consider developing explicit regulatory provisions covering safety inspection, eligibility for financial assistance, and compliance benchmarks. A forward-looking approach would treat hybrid retrofitting as a transitional option subject to rigorous technical validation, economic assessment, and institutional coordination.

The Case for Strategic State Support to Foster Industrial Upgrading under the PTMP

Meeting the challenges—and seizing the prospects—of industrial upgrading under the PTMP will require active and sustained government support for domestic jeepney manufacturers. As industrial catch-up studies emphasize (Malerba and Nelson 2011), successful upgrading depends not only on firm-level initiative but also on deliberate state intervention that fosters coordinated learning, skilled human capital formation, technology absorption, and movement into higher-value activities.

Yet the sector remains fragmented, with weak coordination among manufacturers, suppliers, research institutions, and government agencies. Existing incentives are present but insufficiently strategic or coherent to steer the industry toward sustained technological transformation. Rather than a passive regulatory stance, the transition calls for purposeful state coordination—aligning industrial policy, financing mechanisms, R&D support, and market creation instruments.

Notably, this argument resonates with a growing and increasingly unified call for stronger government backing of local jeepney manufacturing as a means of addressing the twin challenges of public transport modernization and national industrialization. Such calls come from legislators in the House of Representatives (Lalu 2023; Cervantes 2024), transport groups and coalitions (Salamat 2015; Bendana et al. 2020), and academic researchers (Teodoro 2021), reflecting a broad recognition that modernization must be linked to domestic capability-building rather than reliance on imports.

Strengthening Actor Linkages within the Jeepney Manufacturing Sector

Within the jeepney manufacturing sector, deliberate and coordinated efforts by the Philippine government to develop the capabilities of domestic firms remain weak. While some collaboration exists, many potential linkages among actors are underdeveloped, representing a significant missed opportunity by the Philippine government to foster domestic production and sector-wide upgrading.

The state could play a more proactive role in forging new partnerships, coordinating learning, and strengthening existing production and innovation networks. Within the “triple helix” of government, industry, and academia, some collaboration is already in place. The DOST–PCIEERD funds research in transportation and energy across universities. However, it remains unclear whether these publicly funded research outputs have been systematically translated into firm-level innovation.¹²

In order to maximize the gains of such collaborations, the government could explore the establishment of a public research institute (PRI)¹³ dedicated to the automotive¹⁴ and jeepney manufacturing sector. The emerging national center on energy and transportation—being developed through collaboration among DOST, the University of the Philippines, and Cagayan State University—could serve as the institutional foundation for such an initiative.

Another important component of forging linkages is collective industry representation. Unlike sectors with established associations such as the Electric Vehicle Association of the Philippines (EVAP) or the Philippine Parts Maker Association, Inc. (PPMA), local jeepney manufacturers and assemblers lack

12 In their review of PCIEERD-funded projects concerning energy and transportation from 2007 to 2020, Habana and Lidasan argue that there is a need to add more specific evaluation criteria for determining the impact of these research projects, especially in terms of “technology transfer to a manufacturer, establishment of a startup company, deployment of new policies related to the use of the technology, etc.” (2021, 19). As such, it would be good to leverage the gains from these projects (which are really public investments) and feed them back into the technological advancements of the domestic firms via licensing, etc., such as the case of ToJo Motors’ prototype.

13 PRIs provide funding for innovative projects and often serve as intermediaries for collaboration between universities and domestic firms.

14 One example of a PRI is the Thailand Automotive Institute (TAI) which supports the domestic automotive sector through vehicle testing and certification, R&D activities for manufacturers and parts suppliers, among others.

a dedicated industry association.¹⁵ This fragmentation leaves little chance for pushing for their common interests, coordinating research and development (R&D) agendas, and engaging more effectively with government agencies.

Also, the government should continue directing credit and subsidies to support the jeepney manufacturing sector. State-run banks such as the Land Bank of the Philippines and the Development Bank of the Philippines provide an equity subsidy of ₱280,000 per unit to transport cooperatives and corporations acquiring modern and/or electric jeepneys, whether locally manufactured or imported. Move as One Coalition (Bendana et al. 2020) estimates that around ₱400 billion will be needed to procure replacement vehicles under the program and thus calls for expanding the financing facility, raising the subsidy to ₱500,000 per unit, and combining it with commercial bank loans and official development assistance.¹⁶¹⁷ It also proposes concessional lending terms, automatic fare collection–linked amortization payments, and partial credit guarantees for lenders.

A larger subsidy would ease the burden on drivers and operators while stimulating domestic manufacturing by strengthening demand—especially if incentives are tied to locally produced units. Directed credit and subsidies have long been central to East Asian industrial strategy (Stiglitz and Uy 1996). In 1950s Japan, state financing accounted for nearly a third of new equipment lending to priority sectors such as shipbuilding and machinery, while the Korea Development Bank served as a key intermediary for loans to heavy and chemical industries in the 1970s.

Government Incentives

Government support remains pivotal in shaping the trajectory of the country’s electric vehicle (EV) transition. Previous studies (e.g., Rosellon 2021) have documented a range of policy instruments designed to stimulate EV development, including the Investment Priorities Plan (IPP), which grants

15 Ar. Sarao shared that these firms only see one another during jeepney exhibits or senate hearings on issues that impact the sector.

16 For similar studies recommending that the government increase the amount of subsidy for e-jeepneys, alongside other institutional support, please see Agaton et al. (2019) and Gaspay et al. (2025).

17 For a critical examination of the Philippine government’s current efforts to promote the electrification of public utility vehicles (PUVs), see Dimalanta and Atienza (2025).

tax holidays to EV manufacturers and charging station operators; Executive Order No. 488 (2006), which provides zero tariffs on imported components for hybrid and electric vehicle assembly; and the TRAIN Law, which exempts EVs from automobile excise taxes. More recently, the Electric Vehicle Industry Development Act (EVIDA) established a comprehensive framework governing the manufacture, assembly, importation, R&D, and regulation of EVs and charging infrastructure. Taken together, these measures signal formal policy recognition of clean mobility as an important sector.

This subsection, however, turns to the Revitalizing Automotive Industry Competitiveness Enhancement (RACE) program, which provides fiscal support primarily for the production of internal combustion engine (ICE) vehicles and their components. While RACE has been viewed by some domestic manufacturers—such as Francisco Motors Corporation (FMC)—as a potential avenue for accessing industrial incentives, closer examination suggests possible misalignments between the program’s design and the technological direction of Filipino-led clean mobility initiatives. The tensions surrounding RACE illuminate broader questions about whether existing industrial policy instruments are adequately calibrated to support domestic upgrading.

FMC Chairman Elmer Francisco characterizes the measure as a continuation of foreign-biased industrial policies, structured in a way that advantages foreign assemblers of internal combustion engine (ICE) vehicles while providing little to no institutional support for Filipino-led clean mobility initiatives such as the e-jeepney and hydrogen mobility.

The company questions the program’s continued privileging of ICE vehicle production. It also challenges the 100,000-unit minimum production requirement for the incentive as unrealistic for Filipino manufacturers, effectively setting an entry threshold that only large, often foreign-affiliated firms can meet. The reported exclusion of electric jeepneys, hydrogen mobility, and other clean mobility innovations from meaningful support, alongside the allocation of ₱250 million in taxpayer funds to foreign players, reinforces perceptions of policy asymmetry.¹⁸

18 Besides Francisco’s critique, Kaoru Natsuda and John Thoburn (2021) identify broader factors behind the weak performance of Philippine government programs for the automotive industry that warrant attention. These include limited state capacity to enforce the ban on second-hand vehicle imports; the need to more effectively influence multinational assemblers’ decisions to establish production bases in the country despite its relatively small and slow-growing market; the premature liberalization of the trade regime; and a low local content ratio in vehicle production, which raises assembly costs, among other constraints.

If domestic manufacturers perceive the local incentive structure as structurally misaligned with their technological direction—particularly toward EVs and hydrogen mobility—this suggests a potential coordination failure between transport modernization goals and industrial upgrading strategy. Rather than anchoring domestic clean mobility production, RACE may inadvertently reinforce existing ICE-dominated supply chains, even as global markets shift toward electrification¹⁹.

Francisco further states that the firm “will not force itself into an environment that makes it unnecessarily hard for local manufacturers to survive” (FMC 2025b). In response, the company has announced plans to expand operations abroad, citing more coherent incentive regimes and more predictable business environments. These plans include a manufacturing hub in Texas supported by electric vehicle (EV) and hydrogen incentives; an R&D center in California; motorcycle production in Thailand for the ASEAN market; and EV tricycle and “Pinoy Transporter” production in China, benefiting from zero-tariff exports to the Philippines. From an innovation policy standpoint, the migration of R&D and manufacturing investments abroad represents not merely capital flight but a missed opportunity for technological learning, supplier development, and employment generation within the Philippines.

Industrial policy instruments must be carefully calibrated to domestic productive capacities. If production scale requirements, technology eligibility criteria, and fiscal incentives are not aligned with the realities of local manufacturers, modernization may proceed without domestic industrial deepening.

Demand as the Driver of Industrial Upgrading

At the macro level, demand plays a decisive role in shaping manufacturers’ investment decisions. Under the PTMP, 177,852 jeepney units are slated for modernization (LTFRB 2024), including approximately 70,000 units in Metro Manila alone (Roces 2023). This scale represents a historic opportunity to anchor industrial upgrading in sustained domestic demand.

19 On April 8, 2026, Sec. Cristina Roque said that the DTI is scrapping plans to roll out the RACE program after failing to secure a dedicated funding source, following Pres. Marcos’ veto of unprogrammed appropriations (Zapanta 2026). She added that the government will instead proceed directly with the Electric Vehicle Incentive Strategy (EVIS), which is still being finalized - indicating a policy shift toward the promotion of electrified transport.

Dr. Lew Andrew Tria suggests that the government could go further by negotiating local production quotas with domestic manufacturers, ensuring that a defined share of modernization units is produced locally. Serving as a demand-side strategy, such an approach would provide demand certainty to manufacturers, send clear market signals to consumers, generate employment, facilitate technology transfer, and strengthen the domestic manufacturing base.

The Tatak Pinoy Act (RA No. 11981) could further amplify these gains by prioritizing locally manufactured units and components in government procurement. Through bulk orders, R&D subsidies, worker training programs, and supply-chain development incentives, the law offers a powerful mechanism to align public transport modernization with national industrial development objectives.

Policy Recommendations: Modernization as Industrial Strategy and Just Transition

If the Public Transport Modernization Program (PTMP) is understood as a reorganization of the public transport system with far-reaching implications for domestic manufacturing, livelihoods, and commuter and goods mobility, then its policy design must move beyond narrow compliance metrics. Modernization should be calibrated to balance environmental objectives, affordability, financial sustainability, and industrial development. The following recommendations align with the paper's central argument that jeepney modernization may simultaneously address transport reform and domestic industrial capability-building within a framework of just transition.

1. Adopt a phased and differentiated modernization pathway.

Modernization should avoid a one-size-fits-all mandate. Rather than prescribing a single vehicle technology, government policy should permit a menu of compliant options—Euro IV diesel, electric jeepneys, hybrid retrofits, and other viable technologies—matched to route characteristics, operating conditions, and financial viability for drivers and operators. A phased approach would allow environmental standards to improve while mitigating the abrupt displacement of workers and small operators.

2. Strengthen financial support mechanisms for small operators and drivers.

Given the high capital cost of compliant units, expanded equity subsidies (e.g., up to ₱500,000), concessional loans with extended grace periods,

and the removal of onerous collateral requirements are essential. Without calibrated financing mechanisms, modernization risks deepening indebtedness and excluding small operators from formal participation.

3. Institutionalize transparent consultation and participatory governance.

Inclusive processes are essential for sustainable reform. Structured and meaningful engagement with drivers, operators, cooperatives, commuters, and local governments should be embedded in route rationalization, technology selection, and infrastructure planning. Participatory mechanisms can reduce conflict and improve implementation outcomes.

4. Adopt a coordinated industrial policy for jeepney manufacturing.

Jeepney manufacturing, particularly in electric and other low-emission technologies, should be treated as a strategic industry. Coherent coordination across transport, trade and industry, energy, and science and technology agencies is necessary to steer industrial upgrading. Fragmented incentives and short-term compliance measures should give way to a long-term strategy that links modernization to domestic value creation.

5. Promote learning, technology transfer, and expansion of local content.

Where foreign partnerships are involved, agreements should be structured to ensure skills development, technology transfer, and expansion of local content. This can prevent technological lock-in to imported platforms and enable incremental industrial catch-up.

6. The formation of an industry association among jeepney manufacturers and assemblers may further support collective R&D coordination and more effective engagement with the government.

7. Embed PTMP within a broader just transition framework.

As a system-wide transformation of public transport, PTMP must adhere to just transition principles. Environmental standards should apply consistently across both public and private vehicles to avoid disproportionately burdening the jeepney sector. At the same time, investment in affordable, high-capacity mass transit—such as rail systems—should be prioritized to ensure that modernization enhances accessibility and sustainability system-wide. A comprehensive approach recognizes that jeepney reform is only one component of a broader transformation of the transport ecosystem.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

In the preparation of this manuscript, the author used ChatGPT, a generative artificial intelligence tool developed by OpenAI, to assist in improving language clarity, grammar, and overall readability.

All substantive arguments, interpretations, and conclusions presented in this work remain the sole responsibility of the author.

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Lower Ground Floor, Ang Bahay ng Alumni, Magsaysay Avenue
University of the Philippines Diliman, Quezon City 1101

Telephone (02) 8981-8500 loc. 4266 to 4268
(02) 8426-0955

Email cids@up.edu.ph
cidspublications@up.edu.ph

Website cids.up.edu.ph