



## Innovation as a Socio-technical Transition: The Case of Digital Transportation Service Platforms in Indonesia

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### ABSTRACT

The advancement of information and communication technology (ICT) has paved the way for the emergence of digital transportation service platforms worldwide. The emergence of this digital-based innovation in transportation service has triggered debates regarding its legal frameworks. However, digital transportation services have evolved vastly over time and significantly changed urban socio-economic life. The present paper aims to describe the evolution of digital transportation service platforms in Indonesia from the perspective of socio-technical transition developed by Frank Geels and his co-workers. The data used in the paper were obtained from interviews with various actors, field observations, reviews of relevant legal documents, and information from popular media. The results of this study reveal that the transition toward digital transportation services in Indonesia followed a dynamic path in which actors from the government levels, from business sectors as well from local and traditional communities, took part via contested interactions. Understanding this dynamic transition helps in making assessments and planning to achieve sustainability of digital innovation in Indonesia

## I. INTRODUCTION

The advancement of information and communication technology (ICT) has paved the way for the emergence of digital service platforms worldwide, combining elements of conventional

services with digital platform technology such as ones we see in the case of Uber, Airbnb, and many others. Studies have been conducted to look into the effect of ICT on the education sector (Tikam, 2013; Boruah, 2022), the health sector (Majeed & Khan, 2019; Lucas, 2008), and the transportation sector (Gössling, 2018). Gössling especially gave insights regarding ICT as it relates

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to transportation systems, while examining its consequences towards environmental sustainability. From this previous study, we learned that ICT has significantly transformed the way transportation systems are seen and used, as well as how mobility is performed, with far-reaching implications for transportation mode choices and demand.

Many theories have been developed to explain the process of innovation and technological change. Frank Geels and his co-workers developed a socio-technical transition in the early 2000s to integrate approaches to innovation studies into a single framework called the Multi-Level Perspective (Geels, 2005). Multi-level perspectives have been applied to explain a variety of technological transitions in the transportation sector by many scholars, including Geels himself (2012). Gomez-Morantes et al., (2021) used the framework to analyze a successful ride-hailing platform in Colombia, yielding insights regarding the process of innovation, its speed by scale, as well as other implications.

In Indonesia, initiatives for innovative digital transportation services started in 2010. Today, digital transportation services have been widely established in Indonesia, and the transition process has brought significant socio-economic changes in major cities. The present paper aims to describe the evolution of digital transportation service platforms in Indonesia from the perspective of socio-technical transition developed by Frank Geels and his co-workers. We use a case-study research method to analyze the multi-level transition process. Understanding this transition process helps in making assessments and planning to achieve sustainability of digital innovation in Indonesia.

## II. ANALYTICAL FRAMEWORK

The socio-technical transition framework consists of three levels of analysis of hierarchical order. The socio-technical transition occurs through changes at different levels and interrelationships between processes at those levels, namely the niche level, the regime level, and the landscape level. Radical novelties emerge in niches shaped by the broader context of regimes and landscapes.

The diffusion and breakthrough of novelty depend on linkages with ongoing processes at the regime and landscape levels, which create windows of opportunity (Geels, 2005). The emergence and diffusion of innovation thus involve different levels in a nested hierarchy.

Frank Geels further analyzes the socio-technical transition into four phases of innovation: 1) The emergence of innovation in the regime and landscape context as an effort to solve problems at the regime level; 2) Technical specialization and exploration of new functionality supported by a network of actors who are dedicated to technical development; 3) Breakthrough of new technologies in the market, the widespread diffusion of technological products, and competition with the existing regime, all of which are influenced by external conditions and internal drives; 4) The gradual change of regime and its wide-reaching impact on society.

Depending on various factors existing at landscape and regime levels, Geels identifies three possible routes or journeys of innovation. The first route is coined technological substitution with a knock-on effect. Here, the initial regime is considered stable. Innovation is developed at the niche level until it is mature enough, and landscape pressure finally provides opportunities for innovation to enter the regime level. The second route is called broad transformation. Here, the initial regime tends to be unstable with various problems, thus allowing many gaps for innovation from the niche level to enter the regime until finally, the development of the landscape determines the innovations that will survive and form a stable regime. The third route suggests a gradual transformation and only occurs in an extensive technical system where innovation at the niche level is a component equipped with new characteristics.

## III. METHODOLOGY

In this paper, we make use of the socio-technical transition framework to study the events, actors, and their interrelations that shape the emergence of digital transportation services in Indonesia, including its transition route, the key actors involved in its innovation journey, and the

dynamics at the regime, landscape, and niche levels. The study focuses on: (1) the main events in the development of digital transportation service that are analyzed into phases of innovation and the key factors and actors that shape the process; (2) the dynamics of the development of digital transportation services innovations at the regime, landscape, and niche levels; (3) the characteristics of the transition route.

The data used to support the study were obtained using a case-study research method. The data collection includes interviews, field observations, and reviews of secondary sources of information, including popular media articles and laws and regulation documents. The obtained data were then categorized according to levels and events belonging to innovation phases. By understanding the events, the factors, actors, and values involved in the trajectory of digital transportation services are identified and described. Finally, by identifying factors that play a resistance role along the trajectory, we shall assess the future sustainability of the transition. Key factors to be considered in the planning for the sustainability of digital transportation services in Indonesia are then proposed.

#### IV. RESULTS

As a developing country, Indonesia has been facing the challenge of urbanization for the last few decades. In 1980, Indonesia's urbanization rate was only around 21%, but by 2020, it had reached over 56%, indicating a significant shift in population from rural to urban areas (World Bank, 2021). People migrating from rural to urban areas often had difficulty competing for job opportunities with high qualifications, instead tending to settle in informal sectors with low wages. It contributes to the level of poverty in urban areas. Meanwhile, the number of motorized vehicles in big cities has also increased along with the city's increasing demand for mobility, putting more pressure on urban congestion levels. According to the Ministry of Transportation, the number of registered motor vehicles in Indonesia has increased from 49.8 million in 2010 to 115 million in 2020, a growth of over 130% in just one decade. Most of these vehicles are motorcycles,

accounting for around 80% of all registered motor vehicles in Indonesia (Kompas, 2021).

During the late 2000s, people living in cities mainly relied on urban transport (angkot) and conventional private taxis to travel. According to Munawar (2006), the expensive rate of taxi services prevents them from being the people's choice for transportation services. Meanwhile, conventional urban transport services such as angkot or city buses, which are run by the Land Transport Organization (Organda), are not popular due to low vehicle quality and comfortability, drivers' lack of discipline, cases of theft and extortion, complex regulations, and ineffective administration and management systems. Weaknesses in the urban transportation regime turned people's attention to private vehicles, while some used this opportunity to generate additional profits through informal transport services.

Informal transport services, mainly *Ojek* services, provide the comparative benefits of flexible routes compared to public transportation while offering jobs for people of low income and qualifications. Despite operating informally, the Government seemed unwilling to regulate *Ojek* services. In practice, it is generally acknowledged that *Ojek* drivers would stay at specific locations in housing, offices, and shopping centers, known as bases. Each base has a group of *Ojek* drivers and consumers, that other bases should not interfere with. Because *Ojek* drivers carry out operations using their motorbikes, they can bargain the service price with the customers.

Utilizing the opportunity behind *Ojek* practice in Indonesia, Nadiem Makarim piloted the Go-jek business project in 2009, which offers on-demand transportation services through call centers that mediate between *Ojek* drivers and consumers so that consumers need only wait for their drivers to arrive at their pick-up points. This business was later officially established in 2010. As such, the digital transportation service platform well-known today was first founded as a simple call center (Al Hikam, 2021). According to Cervero and Golub (2007), ride-hailing services such as the one provided by Go-jek gained popularity in Indonesia due to their on-demand nature, where consumers can get direct transportation services

without owning a vehicle or utilizing public transportation, which was deemed inadequate. According to Indraprahasta (2016), ride-hailing services are also increasingly regarded as a solution to the urban mobility demand for quick and easy transport while reducing traffic volume.

As with other countries in the world, the use of smartphones in Indonesia kept increasing, reaching 68% in 2014 (Nistanto, 2014). The transition from traditional mobile phones to smartphones was further supported by the development of the national cellular network, as the Government under the Ministry of Communication and Informatics prioritized expanding the telecommunication infrastructure. The development of 4G in 2009, which allows for faster data transfer, also contributed to this progress, imbuing a new lifestyle for the people, supported by digital applications (Pratama, 2021).

Data integration functions, such as one found in Google Maps, which utilized its users' feedback, data sharing between services found in Google Now, which drew data from other applications, and application bundles within one service system, were developed accordingly. These technological developments made it possible for Garrett Camp and Travis Kalanick to establish Uber in 2009 as a referral service that works with smartphone technology, namely GPS capabilities, so drivers and passengers can connect directly and know each other's location (Hastiadi, 2015). Uber's success in America then boosted the popularity of the concept of mobility as a service globally. This concept, along with the concept of transport on-demand, is increasingly seen as the future of cities, encouraging events such as the Mobility As A Service Alliance at the 2015 World Congress on Intelligent Transport Systems that allowed interactions between multinational actors and the exchange of ideas (Matowicki et al., 2022).

The growing idea of a transport service facilitated by digital applications initiated by Uber later prompted various foreign investors to invest in the development of Go-jek as a digital transportation service in 2014 (Ludwianto, 2019). One of Go-jek's investors is Tencent, which discovered WeChat in the Chinese market in 2011,

which was later enhanced with various service features according to the super-app concept, wherein a single platform could provide various life services (Vaswani, 2021).

On January 7, 2015, Go-jek finally succeeded in launching a digital application based on Android and iOS to replace its previous call center service (Kumparan.com, 2022). Go-jek released the Go-Ride feature for transportation to pick up and drop off passengers, along with Go-Send for sending documents, and Go-Shop, which can fulfill all shopping requests through online drivers. Unlike Uber, Go-jek combines the idea of a digital platform for transportation services with the local *Ojek* practice in Indonesia. Meanwhile, Grab, which has been providing app-based taxi services in Indonesia since 2014, also started providing GrabBike services in May 2015.

The user community and many driver-partners welcome the digital transportation service provided by Go-jek and Grab and have started to switch from conventional *Ojek* to online *Ojek*. The Ramadan month in June 2015 especially became a big promotion event, where Go-jek and Grab competed with discounted service prices. High popularity and market demand allowed the two companies to expand and conduct large-scale open recruitment of drivers in August 2015, with many conventional *Ojek* drivers switching to online *Ojek* due to more appealing prospects.

This situation prompted traditional *Ojek* companies and drivers to protest, sometimes through the suppression of online *Ojek* drivers, and question the legality of online *Ojek* activities based on Law Number 22 of 2009 concerning Road Transport Traffic (LLAJ), which states that two-wheeled vehicles are not included as public transportation. The Ministry of Transportation also banned online motorcycle taxi operations on November 9, 2015, but this ban received strong protests from users of online *Ojek* and was finally revoked by the President (BBC News Indonesia, 2015).

Since then, the process of formulating a legal basis for digital transportation services and online *Ojek* began, resulting in the issuance of Permenhub No. 32 of 2016, which classifies online taxis as special rental transportation and



regulates engine capacity specifications, fare limits, transportation quotas, STNK obligations with legal entities, KIR requirements, availability of pools and workshops, as well as online taxi taxation matters.

Nonetheless, not all parties were disputing digital transportation platforms. In 2016, Go-jek collaborated with Blue Bird, Indonesia's largest taxi service company, so Blue Bird drivers could receive orders from GoCar services (Nurhayat, 2017). In 2017, Go-jek launched a feature that allows users to order taxis through the Go-jek application (Yordan, 2017). With other business collaborations and acquisitions, at the end of 2017, Go-jek and Grab began to find stability in application models and technical transportation services, strengthened by service price standards and exceptional payment methods. In May 2016, Go-jek introduced a form of electronic money called Go-Pay following the acquisition of Ponselpay (Koran, 2016; Zaenudin, 2018). In April 2017, Grab also bought a local e-commerce platform called Kubo, which offers a service that allows people who do not have a credit card to shop online (Widiartanto, 2017).

The growing stability of Grab and Go-jek has resulted in many other startup companies trying to replicate Go-jek and Grab, such as Blu-Jek, *Ojek* Argo, Topjek, LadyJek, etc. However, Grab and Go-jek aggressively promoted service prices to the point where the Commission for the Supervision of Business Competition (KPPU) indicated it as predatory pricing, wherein meager prices below market demand were set in order to divert consumers and bankrupt other companies (Jayani, 2019). Of course, this once again caused conflict between digital transportation platforms and conventional public transport associations, which complained of unequal treatment for digital and conventional transportation services before the law.

Thus, the government began issuing a series of regulations governing the practice of digital transportation services in more detail, including Permenhub No. 118 of 2018, which states that application companies should prioritize the safety and security of transportation for their consumers and are required to protect their consumers,

so companies must participate in fulfilling and protecting consumer rights. Further, Permenhub No. 12 of 2019 refined all consumer protection provisions, including arrangements for essential provisions, partnerships, safety, and the suspension of online motorcycle taxi driver partners. The government also issued Kepmenhub No. 348 of 2019, which contains calculation guidelines for application-based *Ojek* services in Jakarta, Bandung, Yogyakarta, Surabaya, and Makassar. This law determines the lower limit, upper limit, and minimum service fees for application-based *Ojek* services according to a zoning system.

Within the same years, digital transportation platforms also expanded their services on a large scale, following the super-app concept. At this time, Go-jek and Grab began collaborating with various service sector entrepreneurs, from large to medium to micro businesses. Service features developed during this time include shopping for food and daily necessities, financial services and digital banking, household services, goods delivery services, health protection services, ticket booking services, etc. This development increased consumers' reliance on digital transportation platforms for daily necessities and expanded the company's economic ecosystem. In 2018, Go-jek Company achieved enough stability to expand to three countries in Southeast Asia, namely Vietnam, Singapore, and Thailand (Hastuti, 2019). Around 2019, Grab also introduced *GrabWheels*, a collaboration product for sustainability and environmentally friendly vehicle programs (Noviyanti, 2019).

In 2019, Go-jek also specifically reiterated its mission through a change of logo, implying that the company is no longer only engaged in ride-hailing services but aims to become a super-app that can solve various customer problems. In 2021, the merging of Go-jek and Tokopedia primarily contributed to the Indonesian economy amidst the pandemic. This merger formed GoTo, the largest technology-based company in Indonesia, integrating the e-commerce ecosystem with the basis of Go-jek's digital transportation services (Yusuf, 2021).

The super-app concept also started to influence other platform companies, such as Shopee

and Traveloka, which added more application features. Another concept that was promoted by digital transportation service platforms and has gone widespread is the *Sharing Economy* concept, which reduces the significance of the ownership of goods by the user community, using instead on-demand services from other parties who lend their assets, as is the case in the practice of ride-hailing. The idea of *Sharing Economy* proliferated in the first quarter of 2020, accompanied by the growth of Airbnb, which facilitates private homes and properties as accommodation facilities. In the digital service ecosystem itself, which has now expanded to other services, the *Sharing Economy* becomes a source of income for many parties, including driver partners, restaurant business owners, and providers of various services (cleaning, massage, health, etc.). It also carries the idea of the *Gig Economy*, which shifts employment practices from full-time jobs to part-time or independent jobs through online platforms to produce cheaper and more affordable services.

At the end of 2019, Go-jek again collaborated with Astra to test electric motorbikes to build Indonesia's more environmentally friendly electric vehicle ecosystem. Go-jek is also collaborating with Jejak.in, a startup that provides solutions based on Artificial Intelligence (AI) and the Internet of Things (IoT) to monitor and manage trees. On the other hand, Grab is collaborating with Pertamina to build a Green gas station. The Government and investors also support Grab and Go-jek's involvement in accelerating the development of an environmentally friendly transportation system.

## V. DISCUSSION

This section is presented in three parts, each focusing on the innovation journey of digital transportation service platforms in Indonesia according to its phases, the dynamics of landscapes, regimes, and niches that have driven the whole process, and the pattern of transition route that digital transportation service platforms in Indonesia have taken.

### A. Phases in the Journey of Innovation

The four phases of the innovation journey were found in the case study of the development of digital transportation service platforms in Indonesia as follows:

#### 1) *Emergence of novelty in the context of the existing regime and landscape (2007-2014)*

In the first phase, digital transportation services initially appeared in technological niches. They were interpreted within Indonesia's dominant urban transport regime, namely conventional transport services such as angkot, taxis, and informal transport services such as *Ojek*, which were regarded as insufficient.

This phase began with the smartphone's emergence in 2007, which encouraged a network of actors at the niche level, especially in the United States, to continuously develop various digital smartphone applications. One of these applications was Uber, which was developed to meet the needs of on-demand transportation services through ride-hailing. The Uber company introduced the concept of digital transportation services to the Indonesian market. At that time, the Uber service, and later Grab, which followed Uber, were interpreted as part of the taxi regime that was enhanced with digital applications. On the other hand, Go-jek, which had started at a niche level as an Indonesian call center platform company, started receiving investments in 2014 based on their development prospects as a digital service platform, as they are unique in the way that they promoted the use of motorcycle taxis instead of cars, resonating with the *Ojek* local practice in Indonesia. The cultural landscape of the digital revolution, the political landscape that promoted information technology innovations, and the social landscape that was pressured by issues of social welfare and urban mobility supported all of those developments where ride-hailing itself was presumed as a form of solution to the urban mobility problem coming from the informal sector.

## 2) *Technical specialization in market niches exploration of new functionalities (2014-2017)*

In the second phase, the social network supporting the idea of digital transportation services developed from a group of start-up initiators into a network of companies, providers, users, investors, and governments, who were dedicated to developing these ideas with their respective interests to produce a set of functional principles, design specifications, and basic regulations that then facilitated the broader diffusion of digital transportation services.

The platform companies proposed information technology as a key to solving the landscape problems of the conventional transportation sector according to public needs and the urban traffic congestion issue through ride-hailing, which theoretically should reduce traffic volume. They also claimed that their platform could benefit service partners through better access to target consumers and the overall economy through increased efficiency. The companies were also supported by investors, some of whom came from international technological companies with solid innovation values. The service user community, looking for effective, safe, and comfortable facilities to support mobility in the cities at a reasonable price, welcomed the new platforms. Meanwhile, the drivers were mainly seeking profitable job prospects, resulting in a shift in the driver's workforce towards digital platforms, which offer relatively higher income. This development was detrimental to conventional *Ojek* drivers and transport companies that previously dominated the urban transport service regime, who protested for equal treatment between digital and conventional transport services. The protest prompted a political response from the Government, which wished to accommodate information technology innovation in the urban transportation service sector as well as the compliance of the transportation service with the laws. This event resulted in the formulation of a new legal framework governing digital transportation service platforms, providing more stable grounds upon which businesses could expand enough that other startups were starting to replicate the digital transportation service platform model at the niche level.

## 3) *Breakthrough, wide diffusion, and competition with the established regime (2015-2019)*

The third phase is indicated by the spread of digital transportation services into the broader market environment, stimulating competition at the market and regime levels before inflicting changes at the landscape level. In this case study, the third phase tends to overlap with the second phase. It implied that the expansion of digital transportation services in the market had occurred before a stable operational and technical model existed. Instead, many features and characteristics of the service were later developed incrementally along with the expansion of the companies.

Starting in 2015, when Go-jek and Grab services entered the market with a boom during Ramadan, the platforms quickly became popular in big cities within the following years with large-scale promotions supported by investors. Several times, it triggered conflicts with the conventional urban transport service regimes and drove changes in the political landscape by introducing new legal frameworks. The Go-jek and Grab platforms then continued to grow by extending cooperative relations with support from investors. Their expansion of services supported by digital applications grew exponentially. Steady growth reflected at the regime level then provides space for actors at the niche level to accommodate the sustainability values that characterize the landscape in their latest innovations. By the end of this phase, the companies had started initiating projects that revolved around sustainable concepts at their niche level, conforming to sustainability values at the landscape.

## 4) *Gradual replacement of established regime, transformations, and wider impacts (2019-2022)*

In the fourth phase, digital transportation services shifted the dominance of the conventional urban transportation services regime, mainly due to the COVID-19 pandemic, which restricted people's movements.

Throughout this phase, the COVID-19 pandemic dominated landscape development, and its effects were prominent at regime levels.

Government policies limiting activities to prevent the spread of viruses had placed economic pressures on people, significantly impacting their livelihoods. On the other hand, restrictions on movement during the pandemic have caused people's activities to shift to online spaces. It increased attention on information technology innovation and the digital revolution, while urban mobility issues no longer had as much gravity. Thus, the role of digital transportation services at the regime level was increasing for the transportation sector and the service sector in general. Go-jek and Grabs' growing service bases also contributed significantly to the Indonesian economy, as restrictive regulations highlighted the importance of business adaptation strategies and the potential role of digital applications in fulfilling daily necessities. In this way, the thriving digital service platforms also drove economic ideas such as Sharing Economy, Gig Economy, Service On Demand, and Super-App into the landscape level. In the meantime, sustainability remained a global concern amid the pandemic. Digital transportation service companies were moving towards sustainable mobility at the niche level through green initiatives and electric vehicles. However, these initiatives have yet to be able to reach the regime level due to higher priorities during the pandemic.

## **B. Nested Hierarchy in Landscape, Regime, and Niche Dynamics**

The case study shows how each new technology emerged in a particular niche, which could be linked to factors in the broader development landscape as follows.

### **1) Niche Novelties**

Digital transportation service innovations emerged and developed in niches nested within a wider regime and influenced by landscape movements. Go-jek services first appeared in Indonesia's informal transport regime with the unique value of on-demand service using a two-wheeled vehicle fleet that could traverse more flexible routes, responding to Indonesia's traffic congestion and urban mobility problems. Meanwhile, Uber first appeared in Indonesia's

conventional public transport regime, particularly in taxi services, but with a ride-hailing concept that appealed from an economic and sustainability perspective.

### **2) Regime Processes**

The development and maturity of digital transportation service innovation at the regime level were related to some processes in the previous urban transport service regime.

Traffic congestion in Indonesia's big cities has long been a problem due to its negative impact on people's productivity, so the practice of ride-hailing, which has the potential to reduce traffic volume, became appealing. With urban areas in Indonesia tending to form urban sprawls, efficiency becomes a vital mobility issue. However, the conventional urban transport regime was often considered inadequate, while taxi services tend to be expensive. On the other hand, the informality of *Ojek* transportation services, with neither standardized prices nor proper management structures, made it difficult to use the service, leaving society open to new options.

On the other hand, society faced rapid technological development and was well-acquainted with digital applications. So, introducing a digital transportation platform was welcomed in the spirit of technological progress. The number of Indonesians who use smartphones has also increased exponentially. By the time digital transportation services entered the Indonesian market, more than half of Indonesians already used smartphones, and telecommunications infrastructure had been sufficiently developed to support the widespread use of digital applications.

The connection between the processes within the existing urban transport regime and the emergence of technological niches that offered suitable potential and new opportunities allowed the digital transportation service platform to rise from its niche to the level of a regime.

### **3) Landscape Values and Developments**

The rise of digital transportation service platforms in Indonesia took place alongside several developments at the landscape level.



### a) Social Development

The issue of poverty and social welfare has long underlined the development landscape in Indonesia. Increased productivity and income are the main goals for transportation service providers and users. The emergence of digital transportation service platforms that could facilitate service with more convenience and optimal prices was a compelling idea.

The mobility problem in Indonesia's cities has increasingly become a complex challenge, especially with the rapid growth of the urban area and population and the volume of urban traffic, respectively. The government has long been aware of this issue and tends to respond by developing mass transit infrastructure that requires significant capital and a long period of time to build. However, the community needs an immediate solution for affordable public transportation for their daily activities. Digital transportation services provide relatively friendly alternatives to people at affordable prices with service standards guaranteed by company principles while requiring only a smartphone device.

### b) Cultural Development

The digital revolution has pushed the world's activities into the digital space, where technological developments offer diverse functionalities to support people's needs. The development of knowledge and the spirit of progress bring together various ideas and resources to facilitate the discovery of various innovations, including digital transportation services. Meanwhile, the formulation of the Sustainable Development Goals (SDGs) brought the world's attention to a development that is mindful of the balance between social progress, economic prosperity, and environmental sustainability. The practice of ride-hailing offered by digital transportation services supports the value of sustainability through the practice of sharing economy.

### c) Political Development

The government had seen information technology as the key to equitable development in Indonesia and was actively developing telecommunication infrastructure throughout the country. Improved

telecommunication networks were a prerequisite for the development of digital transportation services. In the era of innovation, the Indonesian government encouraged information technology innovations from Indonesians so that they could develop and contribute to the country's development from within. Digital transportation services, which offered solutions to local social problems and had tremendous growth potential, caught the government's interest and support.

All developments at the landscape level, whether social, cultural, or political, affected processes at the regime level and caused certain elements to survive and carry out certain functions in society. The overall dynamics at landscape, regime, and niche levels that allowed for the development of digital transportation services presented in **Figure 1**.

### C. Transition Route

In this case study, the development of digital transportation services has characteristics in common with Frank Geels' first transition route, where the urban transport regime initially appeared to be relatively stable without any significant developments. Technological innovation was developed in niche incubations, in this case by actors in the United States, until the idea finally reached Indonesia with Uber's penetration into the market, followed by Go-jek and Grab. Then, digital transportation services introduced at the regime level to solve the urban mobility problems that burdened the landscape. In a short time, the introduction of application-based transportation services at the regime level caused changes with broad impacts on the structure of the urban transport regime, from adjustments of the legal framework for public transport, the practices of users of transportation services, infrastructure developments, and broadly changing people's perspectives regarding the service sector.

However, there are differences between Frank Geels' first transition route and the pattern found in the case study of the development of digital transportation services in Indonesia. Instead of a stable initial regime with few problems, Indonesia's initial public transport regime had significant problems supporting people's welfare

and urban mobility. It was closer to the condition described in the second transition route, albeit a few innovations emerged from the niche level to improve the existing regime so that the conditions of the regime tend to look stable. Thus, in this case, the initial public transport regime could be considered stagnant rather than stable, as it needed to be more optimal.

Furthermore, digital transportation services did not replace the existing public transport regime. Instead, it became an integral part that empowered the evolved regime through information platforms that increased interactions between corporate actors, drivers, and service users. This characteristic is similar to the description of novelty in Geels' third transition route, where information technology in digital applications becomes an additional component in the existing public transport service system. Even so, this case study cannot be classified under the third transition route due to the system's nature, which involves more social ties than a macro-technical system (large technical system).

Overall, an overview of the transition routes for digital transportation services can be seen in **Figure 2**. Here it is presented how, apart from the differences previously mentioned, there is a uniqueness in the case of the development of digital transportation services in Indonesia. Contrary to the assumption of the first transition route, which states that innovation would reach maturity at the niche level before entering the regime, the initial design of the digital transportation service platform had not reached a stable form at the niche level but continued to evolve after entering the regime level. For example, the features offered in Grab and Go-jek digital applications kept evolving, the professional relations between consumers, drivers, and companies were still affected by changes in government policies, and other technical adjustments have only been reconfigured after specific regulations were properly established.

On the other hand, by the time this article was written, the digital transportation service regime had yet to stabilize because large platform companies such as Grab and Go-jek were still dependent on investment funds from various parties and had not yet found a stable price/performance

ratio. Therefore, it cannot be concluded whether or not digital transportation services will remain a sustainable innovation.

However, it is undeniable that the emergence of digital transportation services has evolved Indonesia's technological, cultural, and economic landscape. From the economic perspective, the popularity of Grab and Go-jek signaled the rise of on-demand services with a glimpse of the future of an economy built on sharing rather than ownership. At present, the public increasingly recognizes and relies on sharing economy-based services such as Airbnb. Other companies, such as Shopee and Traveloka, have also widely adopted The Grab and Go-jek super-app models, which now integrate various services into their applications. The concept of gig economy partnerships, where companies only hire workers on short-term work contracts or as freelancers, is also becoming increasingly popular, especially in the accounting, design, and education fields.

## V. CONCLUSION

In this paper, we have shown that the emergence of digital transportation services in Indonesia can be understood as a digital innovation that involves socio-technical transitions. Through Multi-Level Perspective analysis, we have identified the transition route, the journey of innovation, and the dynamics at the regime, landscape, and niche levels that characterize digital innovation. At first, the public transport regime, despite having various problems, remained relatively stagnant, and innovation in the digital transportation services occurred at the periphery of this regime, initiated by a pioneering group of actors. Subsequently, the digital transportation service innovations went up to the regime level, due to the opening up of a 'window of opportunity' triggered by increasing urban mobility issues and sharing economy trends, as well as the strengthening of digital transformation issues at the landscape level. This dynamic eventually exerted pressure at the regime level and stimulated changes in the practices and behaviors of service users, legal frameworks, infrastructures, and business partnerships in the service sector. This regime change was also accelerated by the outbreak of

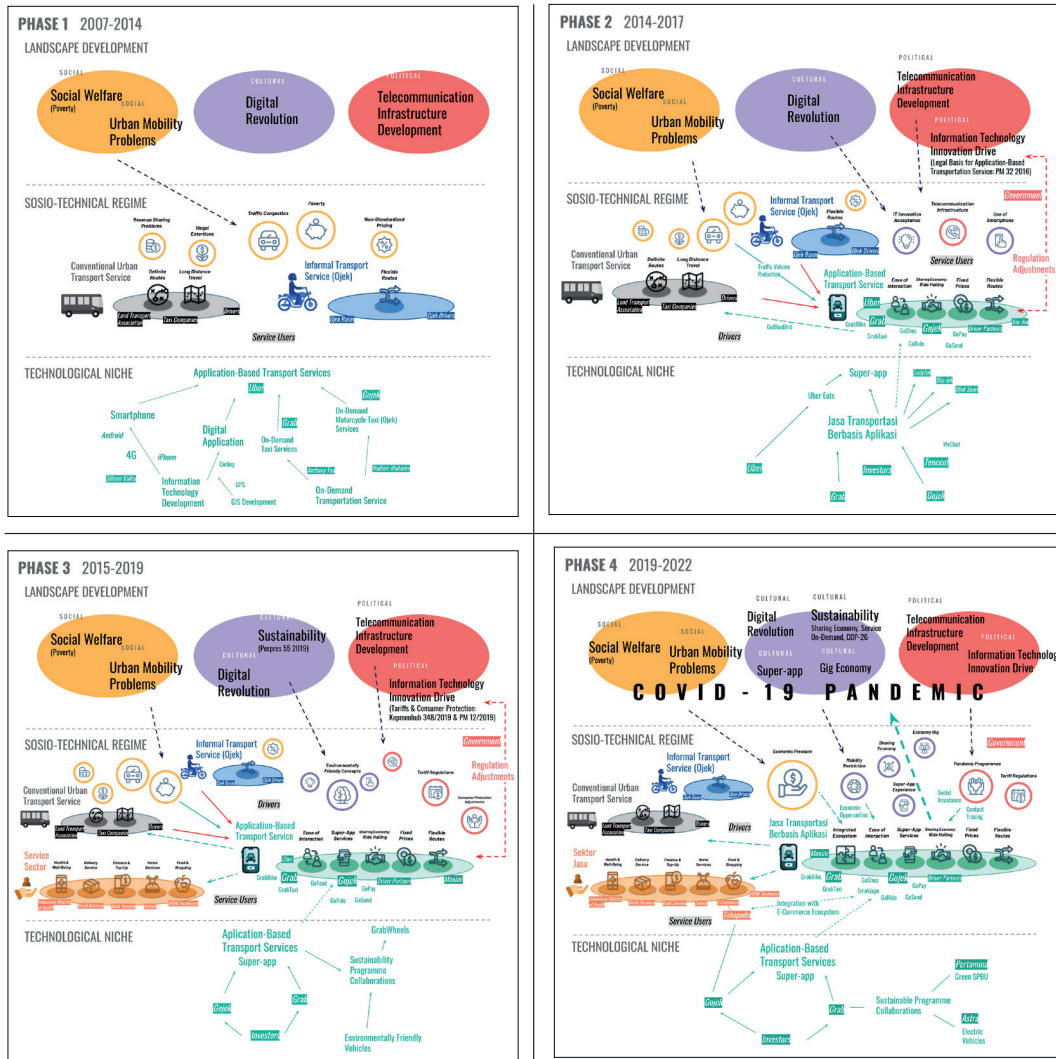


Figure 1. Hierarchy Dynamics Throughout the Phases

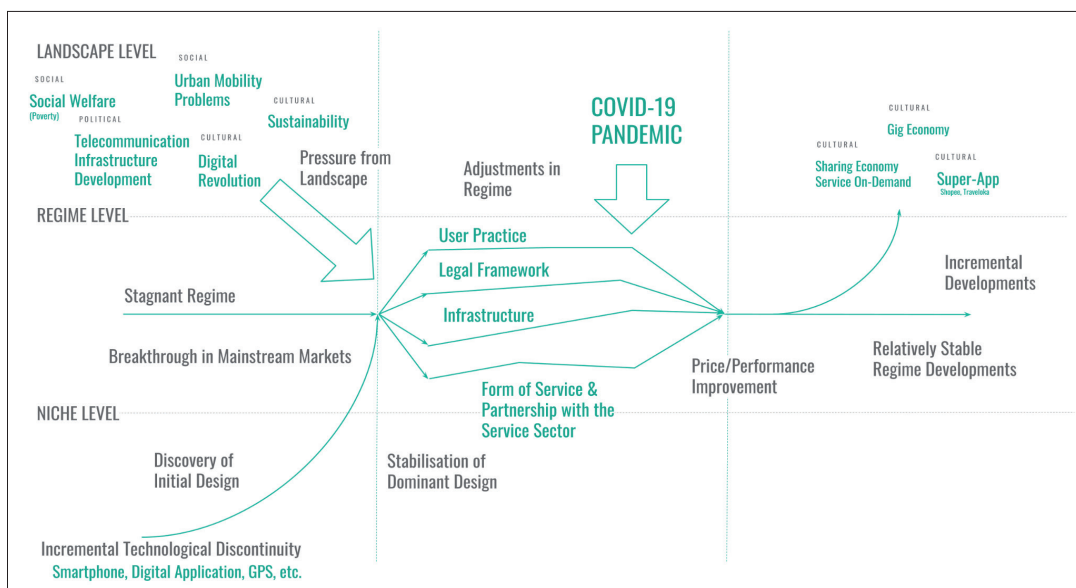


Figure 2. Digital Transportation Service Transition Route

the COVID-19 pandemic at the landscape level, consolidating the stability at the regime level.

In this way, we found that the development of digital transportation services in Indonesia does not clearly fall into the three previously identified patterns by Geels. The initial regime had significant problems (resembling the second route) yet was relatively stagnant, with technological innovation developing in niche incubations before heavily impacting the regime and landscape (resembling the first route). Furthermore, technological innovation finally did not completely replace but became an integral part that empowered the evolved regime (resembling the third route). The innovation in digital transportation services could take such a particular route due to certain factors. Amidst rising potential solutions to the flaws of the public transport regime, digital transportation services were regarded distinctly due to success stories from other countries. The high level of trust from foreign investors and the government's hopeful promotion of entrepreneurship in the country allowed the widespread diffusion of digital transportation services, despite it not having reached stability in terms of market equilibrium nor long-term national and local planning, indicated by constantly evolving regulations. Thus, this study shows that there are other transition routes that an innovation could take, and phases of innovation could be overlap with disruptive consequences.

This observation shows that while digital transportation services have spread far and wide in Indonesia and had significant impacts on the Indonesian service sector's regime and landscape, the sustainability of the regime remains a critical issue. External factors could disrupt the transition at the niche level. Therefore, we recommend that public-private partnerships be strengthened in the future planning of digital transportation services in Indonesia, both at the national and local level. In particular, the sources of investments for digital transportation services need to be diversified to include small businesses at the local levels. Market competition needs to be nurtured to ensure stable equilibrium, while new ideas need to be explored and brought to the market to promote higher added value of digital innovation.

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