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Conceptualising Digital Platforms in Developing Countries as Socio-Technical Transitions: A Multi-Level Perspective Analysis of EasyTaxi in Colombia

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Abstract

Digital platforms play an increasing role across socio-economic sectors in developing countries yet development research to date on this topic has been limited and under-conceptualised. To help facilitate such research in future, this paper presents and applies the "multi-level perspective" as a framework to understand platforms in development as socio-technical transitions. Analysing a successful ride-hailing platform – EasyTaxi in Colombia – it finds what was originally a niche innovation then effected a socio-technical transition within Bogotá's taxi regime. Although there are some issues in applying the framework, it is found to have a factoral, scalar and longitudinal holism that were lacking in existing conceptualisations within the literature on platforms and developing countries. The multi-level perspective offers insights into the process of innovation, rapidity of scaling, and development impacts relating to resource endowments, institutional formalisation, and shifts in power. The framework may therefore be a useful lens for development researchers seeking to better understand digital platforms.

Keywords: digital platform, socio-technical transitions, multi-level perspective, ride-hailing

Introduction

Digital platforms – "a set of digital resources—including services and content—that enable value-creating interactions between external producers and consumers" (Constantinides et al. 2018:381) – play a rapidly-growing role in the socio-economic life of developing countries (Koskinen et al. 2019). Despite growth in studies on platforms in developing countries, research literature remains dominated by studies focused on the global North, leaving a whole gamut of questions under-researched and under-conceptualised within development studies.

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In this paper, we will argue that conceptualisations to date of platforms in developing countries have been too limited in a number of ways; in particular, missing the "big picture" of platforms' role in development by focussing just on specific issues and just on platforms rather than fully analysing the existing sectors into which they are inserted. Here, our aim is to apply and evaluate a conceptualisation not previously used for platforms: the "multi-level perspective" (MLP) on socio-technical transitions (Geels 2010). This sees the introduction of platforms in developing countries as a potential socio-technical transition that brings a new niche innovation into contact with an existing socio-technical regime set within a contextual landscape.

Through a first application of the MLP, we argue that it can be a valuable framework through which to understand that big picture of platforms and development. While presenting some challenges in its application, the framework is shown to provide a holistic understanding of platform implementation, growth and impact; including factors and issues of particular relevance to developing countries. We therefore argue that it can be a valuable lens for development researchers seeking to understand the growing role of platforms in development.

In the next section, we review existing literature on digital platforms and developing countries in order to identify key elements that a conceptual model of platforms and development should encompass, and to identify lacunae in conceptualisation to date. After introducing the multi-level perspective, we explain our case study for application of the framework – EasyTaxi. Although first developed in Brazil, the focus here is the platform's role in the capital, Bogotá, of neighbouring Colombia where, following first introduction in 2012, it came to dominate the taxi bookings markets within less than three years. Following an explanation of our case study research methods, we structure findings around the main concepts of the MLP, and then analyse the insights it has offered into platform growth and impact. We finally discuss and draw conclusions from those findings.

Digital Platforms in Developing Countries

What particular issues and features should conceptualisation of digital platforms in developing countries encompass?

A core issue in understanding the role of digital technologies in development – reflecting a long-standing theme within the technology and development literature (Johnston & Sasson 1986; Dahlman 2007) – is the impact the technologies are having (World Bank 2016). This can be divided into two elements: not just the nature of the technology's impact but also the scale of that impact (Hanna 2010; Heeks 2018). For digital platforms, issues of scale are particularly bound up with network effects which mean the value of the platform to users increases exponentially as more producers and consumers join (Bonina et al. 2021). Where platforms are able to achieve rapid adoption by a large number of users and scale up, they can take advantage of network effects, often achieving a dominant or even monopolistic position in the market. Conversely, slow or low rates of adoption will typically lead to failure to grow and ultimately failure of the platform to have a development

impact. Understanding of platforms' development impact is therefore also bound up with understanding of the technology's adoption and growth; again, a long-standing theme in the technology and development literature (Feder et al. 1985; Foster & Heeks 2013).

In order to understand the particular factors that a conceptualisation of platforms in developing countries should encompass – and given that a review of development studies journal papers provided limited insight into this[2] - we undertook a broader, multi-disciplinary review of literature on digital platforms in developing countries, focusing on the issues just identified: adoption, growth and nature of impact[3].

Three main domains of factors emerged from the literature that shape the adoption or non-adoption of platforms by users in developing countries and resultant scaling-up or otherwise of the platform:

- There are micro-level factors relating to individual users such as the incentives to or benefits from adopting the platform (Yadav et al. 2015; Lu and Xu 2020), or user competencies (skills and knowledge) (Alrasheedi et al. 2015; Thaipisutikul and Tuarob 2017).
- There are meso-level systemic factors, which are mainly understood in terms of institutions: informal institutions such as norms and practices for a particular activity, more formal institutions such as sectoral laws and regulations, or institution-related factors such as platform business strategies (Shao and Kenney 2018; Chrysantina et al. 2019; Mukerji and Roy 2019). This category also encompasses the social and technical actors who create and use the platform, and the relations between them (Jha et al. 2016; Moitra et al. 2018).
- Finally, scaling of platforms is seen to be impacted by the wider macro-level context within which they sit; for example by the nature of the broader digital or telecommunications infrastructure (Artopoulos et al. 2019; Renner-Micah et al. 2020) and the broader social infrastructure such as national systems of finance or governance (Bourreau and Valetti 2015; Andriani et al. 2019; Malhotra et al. 2019).

In a number of instances, treatment of elements has been location-blind: the examined platform could just as well be in a high-income global-North country as a low-/middle-income country of the global South. But we identified from the

[2] As one indicator, in seven leading development studies journals by mid-2020 (Development and Change, Development Policy Review, European Journal of Development Research, Journal of Development Studies, Journal of International Development, Third World Quarterly, World Development), there were only five published papers with 'platform' in the title, only one of which related to digital platforms. The four non-digital-platform papers referred to platforms in the sense of an institutional or economic foundation for development activity.

[3] A total of 107 papers identified in mid-2020 from the first 200 items returned by the Google Scholar search: intitle:platform (digital AND ("developing countries" OR "developing country" OR "global South") AND (growth OR expansion OR scaling OR adoption OR impact)). These do not represent the totality of all literature relating to platforms and developing countries but these papers specifically signal their interest in platforms by using the term in the title, and reflect coverage of the main issues of relevance. The other 93 papers studied non-digital platforms and/or did not relate to developing countries and/or were inaccessible.

literature three ways in which features of developing countries affect platforms[4]. Developing countries often have resource constraints. These may be understood at micro-level e.g. absence of individual capabilities that prevent an individual from using the platform (Chrysantina et al. 2019); or at macro-level e.g. telecommunication infrastructure constraints that make it difficult for the platform to scale (Yadav et al. 2015). Developing countries may experience absence or implementation shortcomings of formal institutions such as laws, regulations, market-forming roles, etc and/or their substitutions by informal institutions. These may, for example, mismatch the formalised assumptions of platform design, leading to implementation and growth constraints (Thaipisutikul and Tuarob 2017; Renner-Micah et al. 2020). There may be notable power inequalities between actors in developing countries. These may, for example, constrain the ability of some more-marginalised groups to become platform users (Malhotra et al. 2019).

These three typical features of developing country contexts are also reflected in the literature from the search on the nature of platforms' impact. While relatively limited, this has looked particularly at micro-level impacts on individuals, such as extent of access to livelihood resources from economic platforms (Surie and Koduganti 2016; Keskinen et al. 2020), gains in subject-specific knowledge from educational platforms (Perera and Aboal 2019), or impact on delivery of public services to users from e-government platforms (Yu et al. 2019). Broader patterns of impact were even less-often investigated but these included meso-level changes in institutional form e.g. from absence to presence, or informality to formality (Mukerji and Roy 2019; Heeks et al. 2020), and changing distributions of power between groups including changes in social relations and resource distribution (Arora and Thompson 2019; Ye and Yang 2020).

Conceptualising Platforms and Development

The literature to date has therefore been very helpful in identifying a series of socio-technical elements that need to be considered when analysing the role of platforms in development. These findings are not necessarily comprehensive, given the relatively recent and limited nature of research on platforms in developing countries, but the domains and factors echo prior perspectives on the development impact of technology (Duncombe & Boateng 2009; Ugur & Mitra 2017). We can therefore argue that at least these – as summarised in Table 1 – should be encompassed by any conceptualisation of platforms and development.

[4] Acknowledging that these features are not universal to developing countries nor are they absent from high-income countries but they are typical of developing countries.

Table 1 Key platforms-and-development elements

Domains	Adoption/growth factors	Developing country-specific features	Impact dimensions
Micro-level	User incentives User competencies	Resource deficits: skills and knowledge	Livelihood resource provision Improved service delivery
Meso-level	Informal institutions Formal institutions Business strategy Actor relations	Institutional shortcomings Power inequalities	Institutional formation or formalisation Power redistribution
Macro-level	Technical infrastructure Social infrastructure	Infrastructural / resource deficits: technology, finance	

Reviewing the current conceptualisations offered in the literature on platforms and developing countries, however, we find three specific lacunae beyond a main finding that conceptual frameworks were not often used. First, while this review of literature has allowed us to collate and categorise factors of importance, these are not brought together in current analyses. The full gamut of factors and levels identified above was not covered by any one paper. Where conceptual frameworks were used, they focused on single domains such as the individual user via the uses and gratifications framework (Alrasheedi et al. 2015; Pang 2018), stakeholder groups via actor-network theory (Moitra et al. 2018), or systemic institutions via institutional theory (Mukerji and Roy 2019; Renner-Micah et al. 2020).

Second, the focus for analysis has been narrow and a-historical; looking at the current platform. Even if systemic meso-level institutions or macro-level context are acknowledged, there is almost no explicit recognition of or comparison to existing ways of organising or delivering the particular social, economic or political activity. Yet, the developmental impact of a platform can only be understood in relation to these 'existing ways', and the scaling of any platform is based on the intersection of new and existing technologies and practices, and is either implicitly or explicitly in competition with existing alternatives (Mukerji and Roy 2019; Offenhuber 2019).

Third, literature has focused on either implementation and growth of platforms, or on their impact, but not both. Yet, as noted above, any technology's development impact consists of both nature and scale and, in practice, the implementation, scaling and impact of platforms are inextricably intertwined (Gawer 2014; Constantinides et al. 2018).

In sum, and notwithstanding the contributions of research literature to date, development research has lacked the demonstrated application of a comprehensive framework through which to understand digital platforms. Hence, the call for more- or better-conceptualised research on platforms and development including issues of adoption, growth and impact (Koskinen et al. 2019; Keskinen et al. 2020; Omulo and Kumeh 2020). In seeking to address this call, we have identified the elements and

scope a conceptual framework should cover; yet did not find a framework in use that met these criteria. In the next section, we identify one that might.

Platforms as Socio-Technical Transitions and the Multi-Level Perspective

We sought a conceptual framework with potential to integrate the various socio-technical factors and levels identified as important in developing countries, to analyse not just the platform but also the pre-existing basis for organisation and delivery of activity, and to analyse both growth and impact.

We identified equivalence between the introduction of digital platforms and the idea of socio-technical transitions: changes from one socio-technical configuration to another (Geels 2002). In surveying the literature on socio-technical transitions, we identified the multi-level perspective (Geels 2002; Geels 2004) as being of particular potential relevance. In summary (see also Figure 1), this focuses on four elements: three structural which operate at different levels plus the innovation process of transition.

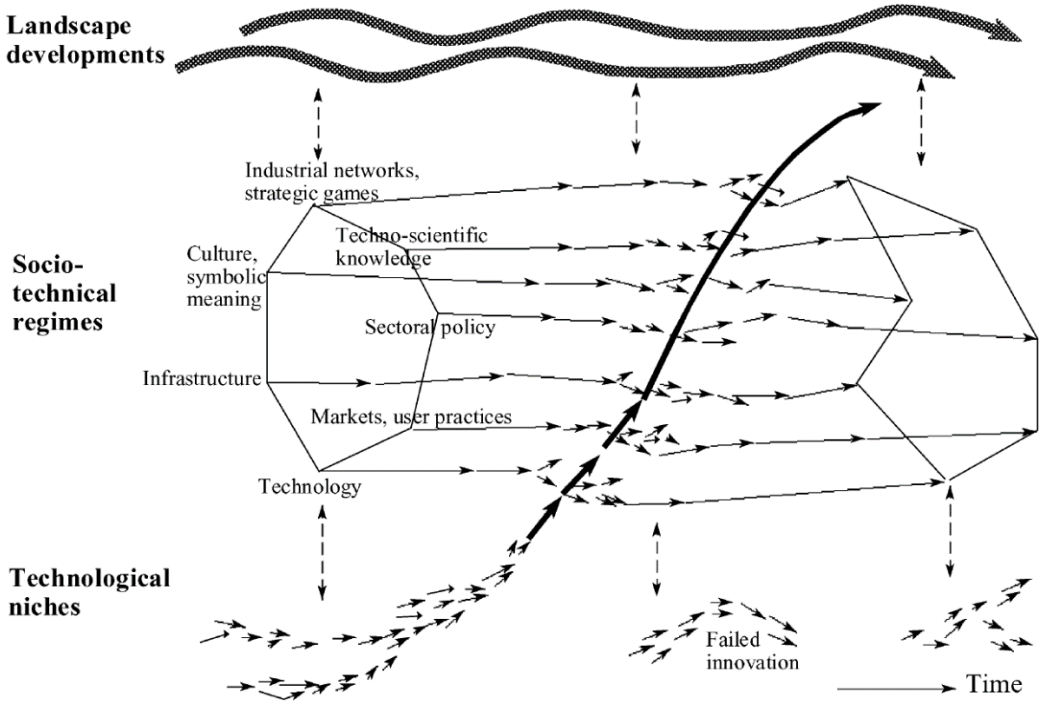

Figure 1: The Multi-Level Perspective on Socio-Technical Transitions (Geels 2002)

There is the broader landscape of long-term "demographical trends, political ideologies, societal values, and macro-economic patterns" (Geels 2011:28) that are "beyond the direct influence of actors" (Geels 2004:913). This represents the wider context within which a socio-technical regime operates. It can therefore incorporate the macro-level domain of contextual factors seen from the existing literature to have a potential impact on the growth of platforms in developing countries.

The socio-technical regime is a configuration of linked elements including "technology, user practices and application domains (markets), symbolic meaning of technology, infrastructure, industry structure, policy and techno-scientific knowledge" (Geels 2002:1262) that guide the activities of actors in some common endeavour. The definition of regime components differs between writings on MLP. As shown in Figure 1 there are seven. However, we sought to simplify somewhat and, in the analysis that follows, we organise material into four regime components. These drew on Geels (2014) and Scott (2014) but also sought to incorporate the micro- and meso-level domain factors identified above from the specific literature review of platforms in developing countries. These are: resources (physical artefacts such as technology but also intangible assets such as data and knowledge), routines (standard processes and practices), relations (social connections between actors), and institutions (both formal such as regulations and informal such as discourse).

The third element is the technological niche: a relatively protected space within which learning and innovation can occur. In our application of the MLP, the technological niche will be understood as the new digital platform and the space in which it is developed and initially implemented. As indicated in Figure 1, innovations such as new platforms typically make their way into contact with the existing regime. The framework can thus offer the historical and comparative perspective identified as missing in the current platforms-and-development literature. While some platforms will fail to scale, others succeed and, in doing so, they reconfigure the regime; transitioning it from one socio-technical system configuration to another.

That transition – the fourth element of the MLP representing the intersection of socio-technical regime and new platform niche – would encompass not just the elements already identified (resources, routines, relations, institutions) but also the issue of incentives. Coverage of incentives is important given its identification in the literature review above as a key factor in the growth or otherwise of a platform and, hence also, in shaping the development impact of a platform. The process of transition can be understood to cover not just implementation and scaling but also the developmental impact of platform: the changes that it enables or requires in the components of the socio-technical regime. Directly relevant to two of the development impacts identified from the literature review – changes in resources and changes in institutions – these could also provide an insight into the third impact: the changing distributions of power, given resources and institutions constitute the key components of power within the multi-level perspective (Avelino et al. 2016).

The multi-level perspective is not widely-used in development studies, though it has started to provide the framing for some analysis of environmental or environmental services transitions (Yasmin et al. 2018; Okereke et al. 2019). Although it has not yet, to our knowledge, been applied for analysis of digital platforms in the global South or North, the MLP framing seems to offer a relatively comprehensive way to understand the wider development implications of introduction of platforms: all of the factor domains identified in past literature including those of particular relevance to developing countries; not just the platform but also existing systems

and context; and both scale and nature of impact in terms of factors that shape the transition to a platform-based regime, and also the changes that occur in that transition. Given this potential value of the framework, we therefore set out to test it through application to a case example, as discussed next.

Methods

Application of the multi-level perspective has typically used case studies of particular technologies and we therefore adopted a case study research strategy[5]. We selected as our case, the EasyTaxi ride-hailing platform in Bogotá, Colombia for three main reasons: the rapidity and extent of its adoption and scaling made it a platform success story: one that has sustained and has had sufficient impact to warrant analysis; it is representative of a type of platform now operating in hundreds of developing country cities, making it of general interest (Brail 2020); and key stakeholders were willing to participate in data gathering. It can also be seen as fairly typical of digital platforms: both referring to itself as a platform and fitting the definition given above because it provides digital resources (an app, location-based mapping, rating scheme, etc) that enable value-creating interactions (taxi bookings and journeys) between external service producers (taxi drivers) and consumers (passengers) with EasyTaxi acting as platform intermediary for this two-sided market. Though the phone-/tablet-based app is the most visible component, it is the back-end, server-based platform that holds the power of data, data analysis, and market/driver management.

One challenge in operationalising the multi-level perspective is setting the boundary of the regime (Geels 2011). This is an analytical determination and for our case the boundary lay around the taxi sector in Bogotá. This can be seen as a "common endeavour" within which the socio-technical transition – introduction and widespread adoption of a digital platform – occurs. Data-gathering was therefore designed to encompass this regime and its components plus the other two levels of the MLP: the landscape and the niche innovation. Following good practice in case study research, we triangulated evidence from three different sources (Yin 2018). 24 face-to-face interviews were conducted in total and audio-recorded: 14 with taxi drivers (both users and non-users of EasyTaxi), four with EasyTaxi managers, four with central and city government officials, and three with other stakeholders (taxi owners, union officials). A form of participant observation was used, in being a passenger-user of EasyTaxi and of traditional taxi operating companies, undertaking a total of 45 journeys with notes taken on the experience. Secondary documentation was analysed including commercial brochures, regulatory documents, and news articles.

Transcribed notes from all sources were combined and analysed using NVivo, with a first coding cycle using attribute and descriptive coding techniques then being refined and categorised based on the MLP (Saldana 2009). As an overall structure, the analysis frame for this process used the four main elements of the MLP as

[5] Our literature review also indicated that a case study approach has been typical of analyses of digital platforms in developing countries.

identified above: the socio-technical regime and also the broader landscape as they existed prior to arrival of the platform, the niche innovation of the platform as it was implemented, and the socio-technical regime following platform introduction. As also described above, the two regimes were coded according to the four elements: routines, relations, resources and institutions. Of the potential macro-level elements offered by the platforms-and-development literature and by the MLP for the landscape, only two emerged during coding; one related to urban mobility and one to digital infrastructure alongside more inductively-identified issues of poverty and criminality. For the niche innovation, as per both our literature review and the MLP, the analytical focus was on the key aspects that lead an innovation to succeed or fail: the incentives and barriers to adoption by a critical mass of users.

Findings

As per our coding, the findings below are structured overall in terms of the four main elements of the multi-level perspective: existing regime, landscape, niche innovation, and transition. Within each of these sections, however, we do not adopt a mechanistically-structured approach of dealing with each coded element in turn. Instead, we follow Geels (2002:1263) approach of "a mosaic style of writing" that interweaves the elements. Later analysis will return to a more structured summary.

The Pre-Existing Regime

Travel by taxi is estimated to make up just over 8% of motorised journeys in Bogotá (Rodriguez-Valencia 2014) and, in terms of routine practices, Bogotá's yellow cabs pick passengers either through on-street hailing or through pre-booking. Historically, pre-booking was made by phone to one of the city's taxi operating companies (TOCs) that owned memorable phone numbers (e.g. 211-1111) and also owned radio frequency licences. The booking would generally be communicated to drivers via an open radio call from the TOC despatcher with the first driver to arrive at the location getting the fare:

> *Radio bookings are very hard-fought. Four or five cars [fought] and it was to see who got there first. … They cut each other off, one of them would jump into the pavement, and they could even get into a fist fight in the street. It was terrible*. (Taxi Driver 1)

During the early 2010s, just a few taxis had a GPS-based screen system installed with on-screen response. Taxi owners – it was relatively rare that drivers would own their vehicle (Rodriguez-Valencia 2014) – paid a monthly *rodamiento* fee to the TOCs: affiliation to a TOC was an operational requirement. The fee ranged from around US$18 without a radio (i.e. just on-street hailing) up to c.US$55 for affiliation with GPS installation. Drivers also had to register with a TOC, though this was often quite informal. Drivers paid the owner a flat-rate fee per shift of around US$45 plus a deposit (c.US$175) and daily 'savings' (c.US$2.50) that accrued against any accident damage to the cab. They also paid fuel costs (c.US$20) and a daily carwash fee (c.US$2.50).

The oligopoly power of taxi operating companies – three-quarters of taxis were affiliated to just five TOCs (Ibanez Perez 2012) – was based on resources and relations: the power of easy-recall phone numbers, the cost and scarcity of radio frequency licences, and contacts with national and local transport regulators. Taxi owner power but also competitive pressures arose from scarcity of taxi operating licences as a resource. Capped at 50,000 since the early 1990s, the cost of buying a taxi operating licence from an existing owner had risen to more than US$40,000 by the mid-2010s. Looking at drivers, high unemployment and poor social security pushed individuals to take up taxi driving in order to earn money, and there was strong competition for work:

> *In Colombia the transport industry is a receptacle of poverty, the quick exit for jobless people or people lacking other qualifications or skills. … So far, there is no specific test for taxi drivers. Because of this, anyone can be a taxi driver.* (City Official)

From a resource dependency perspective, then, TOCs and owners could readily substitute drivers, and this served to weaken the power of driver unions. Other social institutions – such as those of law enforcement – also had weaknesses which shaped the regime.

This provided some basis of stability for the regime in terms of main actors: regulatory institutions were unchanging; barriers to entry were so high for TOCs and even for taxi owners that their structures were static; and the churn of individual taxi drivers made little difference to the regime.

However, these factors also underpinned tensions that created a backed-up pressure for change. Three resource-competitive forces intersected on the drivers: from the taxi owners for earnings, from other drivers competing for fares, and from the pool of unemployed who could substitute them. These led to various over-competitive practices among drivers: refusing passengers who wanted low-value journeys; aggressive driving to reach a potential fare first and to complete journeys more quickly; refusing to use the meter and other forms of overcharging; hacking the meter in order to extract higher earnings; complicity in robbery of passengers (see also Fink 2011; Ballen Pachon 2012; Muse 2013):

> *[Drivers each day] <u>have</u> to pay the taxi owner COP80,000. Add to that COP30,000-40,000 of fuel, that's COP120,000 COP. They have to clean the car ever day and they have to cover the daily deposit; that's COP130,000. When do they make their own money? When I'm on a good day, I make COP130,000-150,000 in the 12 hours I work. … That's why those kids are so [prone] to taking advantage of passengers... All day trying to rip passengers off, messing with the taximeter, refusing service, all of that.* (Taxi Driver 2)

TOCs had some power to address this through sacking or fining drivers: however, drivers could register from scratch – with a clean record – with a different TOC (though taking a hit on earnings when moving to one with a smaller market share). Poverty, criminality and institutional weakness within wider Colombian society led to so-called "millionaire rides" (fake drivers and accomplices robbing passengers by taking them to one ATM after another to obtain cash) and felonious passengers

robbing taxi drivers (who generally only transacted in cash). Whatever the actual prevalence of these activities, it was their widespread profile that fostered insecurity and mistrust of drivers and passengers.[6]

Mistrust was also rife between drivers and owners/TOCs because of the perceived exploitative nature of their relationship with asymmetries of risk-bearing and value-taking. TOCs were seen as rent-seekers, monetising their resource oligopoly but not intervening in disputes between owners and drivers, not training drivers, and assuming no responsibility for the quality of the service, the working conditions of drivers, or the cars: *"the TOCs won't help you with anything*" (Taxi Driver 3). Efforts to regularise the employment status of drivers e.g. to provide training, insurance, pensions were blocked by the TOCs. Owners bore some risk but, if they had problems with drivers e.g. around sickness or late payments, they just got rid of them. Drivers bore the main costs and risks. Accidents, breakdowns, robbery, traffic tickets, lack of passengers, and being stuck in Bogotá's congestion were all their problem:

> *I had an accident because of the tyres. I brake but the car didn't stop and I ended up rear-ending another car. My taxi ended up worse than the other car. I ended up paying… I paid the repair of the taxi because we have to pay from the deposit and the daily savings. So either you pay or they use the deposit money for that. And if you don't pay they take the deposit and fire you; it ends up badly.* (Taxi Driver 4)

> *We are on our own. For example, if you crash you go to the TOC and ask for help "can you please help me with legal assistance or something" – "no, that's your problem". I mean, we are on our own, subject to God's will. That's the driver's problem. Now, owners don't care about you. Do you know what their first question is when you have an accident? "Is the car OK?" That's all; they only care about the car. They couldn't care less if the driver is OK or not.* (Taxi Driver 3)

When fuel prices rose that ate into drivers' earnings. Owners sometimes faced increased costs e.g. if the *rodamiento* charge was increased, and sometimes faced increased earnings opportunities e.g. if city-wide fares were increased. In either case, they increased the tariff charge to drivers: passing on cost rises, capturing price rises.

The Landscape

Landscape features of poverty and insecurity have already been noted, and fracture lines apparent within the regime were opened further by other landscape pressures. As noted, the number of taxi licences had been static for more than 20 years; yet, during that same period, the population of Bogotá had risen from 5.5m to 8m. Combined with GNI per capita growth from just over US$1,000 to c.US$7,000, urban mobility and demand for transportation increased significantly, making it

[6] Noting that insecurity and mistrust characterise not only other forms of transport e.g. buses (Kash and Hidalgo 2014) but life in the city more generally (Zeiderman 2016).

increasingly difficult for passengers – often middle-class and politically-vocal – to get a taxi during peak hours. At the same time, the technological terrain was shifting. Colombia is only an average digital economy performer in regional terms but its Ministry of ICT has helped create reasonable competition, pricing, portability of numbers, and service quality in the mobile broadband market (Meltzer and Marulanda 2016). Supported by a growing ecosystem of mobile/broadband service providers and phone/tablet suppliers, retailers and repairers, this saw mobile penetration rise from six subscriptions per 100 people in 2000 to 120 per 100 in 2015, and mobile broadband rise from 9 per 100 in 2009 to 42 per 100 in 2015 (ITU 2020).

The Niche Innovation

Into this highly-susceptible context of internal and external pressures stepped EasyTaxi as a personal transportation digital platform. At its core is a smartphone app bringing a different routine. Passengers register their details on the platform via the app and place a journey start/end booking; the first available driver to respond gets the booking; the passenger can then see the driver location, estimated time to pick-up, driver/vehicle details, and estimated fare; the app tracks the journey, and at the end the passenger can rate the driver and other aspects of the trip. Passengers can register and pay in-app via credit card but in practice the great majority of payments are still made by cash (drivers are less likely to accept pay-by-card bookings). While guided by the EasyTaxi estimate, fares are still calculated by taxi-meter and according to the standard tariff set by the city transport department. Once drivers are registered, they are charged a US$0.30 per-booking fee by EasyTaxi which decreases the greater the number of bookings in a given month (a very different philosophy from the flat-fee *rodamiento* payment drivers must make to the cab's owners). The app is just the interface for the underlying platform which captures all the data; estimated at up to 300,000 passenger/driver requests per minute across all of EasyTaxi's multi-country operations by 2015 (AWS 2015).

EasyTaxi's design had to provide utility to two main groups: drivers and passengers. For drivers, the promise was that they will get more bookings more easily with fairer treatment and, more powerfully and particularly as network effects took hold, there was the threat of losing business if <u>not</u> registered with EasyTaxi. For passengers, there was a greater sense of certainty and security that the app confirms the booking, allows them to track the taxi, and to know and check the identity of their driver.

Network effects are a major challenge for digital platforms seeking to effect a socio-technical transition: the value of the platform to users increases exponentially as more buyers and sellers join and, hence, the platform must rapidly recruit both. Thus platforms may not readily have the type of protection seen as typical for niche innovations: time free from market and other pressures of the existing regime in order to learn, build relationships, revise designs, etc (Geels 2002). However, EasyTaxi was able to protect itself in three ways in its original market, Brazil (EasyTaxi Manager 1, see also McConnell 2011; Scheller 2012; Oliveira 2013; Stewart 2013). During 2011, the development team attended three start-up "boot camp"-

type events (winning competitions in each) that enabled highly-accelerated learning, iteration and relationship building with key business, urban governance and finance stakeholders. During 2012-2013, EasyTaxi received successive rounds of substantial external finance that provided time and space for further revisions but also to build the base of users to a sufficient level. And the agile, "lean start-up" approach used by the development team greatly reduced the protection time required for innovation. For the Colombia implementation, the original Brazil developments represent a protected niche from which a near-complete product could be transferred[7].

Like all platform implementations, roll-out in Colombia faced a series of barriers but, in part due to learning from the earlier implementation in Brazil, these were relatively easily surmounted. Regulatory barriers and the social capital of existing taxi firms were sidestepped when the government accepted EasyTaxi's argument that it was a communications services, falling just under the jurisdiction of the Ministry of ICT, rather than a transportation service, which would have fallen under the multiple jurisdictions of the National Transit and Transportation Ministry, the Ports and Transport Superintendency, and agencies within Bogotá City Council.

Taxi drivers lacked phones and capabilities to use them and EasyTaxi had to address these constraints:

> *Less than 1 in every 100 drivers had a smartphone. Our entry strategy was reaching and talking to them about the app. We showed them the platform and told them "this is going to be free for a time so you can test it and see what it is all about". Since they didn't have smartphones, we had to finance some at the beginning. That is, we gave them smartphones so they could test the app and see how it worked. … At the beginning, when we started with the pioneering drivers, we obviously had to make a very educational effort of sitting with them and tell them "look, this is a new work tool for you. This is a smartphone and it uses a touch screen", and the touch screen wasn't easy to use for them; they weren't used to it. But little by little we got them used to it. Our app is very easy to use, so we didn't have much trouble there. The problem was getting them accustomed to the use of smartphones per se.*
> (EasyTaxi Manager 1)

> *We make an activation process, so what we do is look for them in their points, in their social foci; where they rest or where they go for lunch. We make a fieldwork to determine where drivers concentrate in any new city. Then we send a group of marketers to make brand positioning and invite them to work with us. If they have their paperwork ready, we activate them right there.*
> (EasyTaxi Manager 2)

[7] A few local customisations were still required e.g. around ways to specify passenger location; something notoriously difficult in Bogotá and other Colombian cities. However, the technical design of the platform and app allowed it to immediately customise (e.g. in terms of map, language, taxi links) to the location in which it was opened (EasyTaxi Manager 3).

Through these financing, training and marketing methods, EasyTaxi was able to build a critical mass of driver-users and then turned its marketing to create a critical mass of passengers. That critical mass was essential in overcoming the epistemic barrier of awareness: the advertising and promotional campaign was valuable but EasyTaxi managers argued that word of mouth – from drivers to other drivers, from drivers to passengers, from passengers to drivers – was key to diffusion and adoption. One driver illustrated:

> *I heard about EasyTaxi at the car wash [from fellow drivers]. Because… this started around 2013, I think. I started to hear about this in the car wash around January, everybody was like "Wow, these [mobile booking] apps". … So I bought a phone and a mobile internet plan. And I learned playing with it.* (Taxi Driver 4)

By the end of 2015, there were more than 55,000 driver-users in Colombia (up from 18,000 two years previously and from zero four years previously[8]); it was being used by the majority of drivers in Bogotá (though often in combination with other apps). EasyTaxi had a claimed 90% market share of ride-hailing apps in Colombia[9] and the great majority of driver bookings now came from EasyTaxi not the traditional radio/GPS system. Competition had also, at least to some extent been addressed. TOCs tried to stop drivers using the platform, but in vain:

> *What they've done is try to talk to taxi drivers, tell them "look, if you use Easy Taxi, you cannot work with us". At the end, when Easy Taxi starts to send more bookings than [TOCs], that threat, to put it that way, loses its value.* (EasyTaxi Manager 1)

Attempts by TOCs to set up their own app largely failed with only Taxis Libres succeeding, and then only with small market share. As noted above, the TOCs' political relations and capital was contained within the transport sector, not the Ministry of ICT. They therefore had little or no leverage to influence regulation of EasyTaxi.

Local firm Tappsi launched at around the same time. While it existed as a separate app until 2018, the firm was bought and then steadily merged into EasyTaxi's operations from late 2015. Only Uber, which launched "quietly" in 2013 has presented serious competition since around 2015. But it has faced far more aggression from traditional taxi firms, owners and drivers and from government than has EasyTaxi because it does not work with the traditional, licensed yellow taxi drivers (Griffin 2016; Wade 2017). This has worked to the advantage of EasyTaxi as Uber, rather than it, has acted as the lightning rod for resistance to change in the taxi industry.

Regime Transition

As per the model above, we look here at four regime elements that changed during the transition: routines, relations, resources and institutions. EasyTaxi inscribed into the app elements of the journey process and captured data about them for its

[8] By 2018, the figure was 110,000 with more than two million passenger-journeys per month (Gonzalez 2018).

[9] Though the latter includes Tappsi.

platform. These are elements that were not previously formally recorded: booking, passenger and driver locations, directions to reach the passenger, reporting the passenger on board, cancellations, journey route and completion, passenger rating of driver. Data that was largely lost in the past was thus now owned by the platform, which allowed it to undertake data-based algorithmic management. At an operational level, for example, it checks that drivers adhere to certain performance standards and intervenes if they fall short. At a more strategic level, it analyses booking demand patterns and advises drivers about prime times and locations. Notwithstanding ownership of data by the platform, some is shared. Passengers get critical data they previously lacked: the visual identity and rating of their driver[10], type of taxi (e.g. allowing booking of a larger one if carrying a lot of luggage), the taxi's exact location and route; and drivers also get new data e.g. a record of their bookings and estimated fares.

The technology ownership system changed. Memorable phone numbers were still owned by the TOCs but their value was steadily diminishing as more bookings were made via the digital platform. Radio and GPS systems were typically owned by the TOC and rented by owners but drivers own the smartphones/tablets themselves. The multi-functionality of these devices was also exploited by drivers: they used Waze or Google Maps to find their way to passengers and to plot journeys; they used WhatsApp to share information with other drivers about accidents, road blocks, or police operations. But one notable feature was that – while the old GPS systems had been ditched since EasyTaxi had rendered them redundant – radios were still retained in most cabs. A central feature of a taxi platform is that it disintermediates the despatcher out of the process, but drivers valued what the despatcher provided. They could ask for directions not well-covered by map apps e.g. specific buildings; and especially they sought help when there was a problem; particularly to summon help from fellow taxi drivers:

> *I also have a radio, but I only use it for emergencies with another driver, with the police, with whatever may come. I can use it to ask… well, I know many hospitals, I know a lot of places, but if I'm caught off guard by a passenger asking for a notary's office I can ask the radio operator "can you help with a notary's office near this address", and a colleague will reply. I cannot do that with the app. If I felt any kind of pressure from a passenger or have a problematic passenger I can [use the code] in the radio QR2, QR3, QR4, QR7 which is the police, whatever I need, and other drivers will come to help me in 10 minutes. Neither Easy Taxi nor any of the other apps can do that.* (Taxi Driver 5)

This also highlights a recurrent theme from interviews: the continuing presence and importance of driver groupings. Some of these were formal such as the unions which organised protests against Uber. Others were small, informal groups called via the radio – and rapidly responding – for example if a driver faced an aggressive or non-paying customer. These acted as a counter-balance to what would have been

[10] Drivers cannot rate passengers: they have requested this but EasyTaxi refused, saying this would prevent potential for racial discrimination by drivers for which they might be held liable.

the 'natural' structural relations of the new regime; an atomised and automated relation just between individual drivers and the digital platform. Even EasyTaxi itself had countered this because it organised feedback channels between the company and the drivers: not just email and social media but periodical focus groups to get feedback on the app specifically and more generally on the function of the platform-based approach. Passengers similarly – who could only contact the old TOCs via the despatchers on the main phone number – were given multiple contact channels: in-app feedback, email, social media and a call centre.

Finally, if we turn to institutions, then we can see a regulatory shift. The quotidian regulation of drivers used to come via owners or TOCs but it was fairly loose, informal and sometimes rather capricious. Under the new regime, registration procedures with EasyTaxi were much stricter than those with the TOCs:

> *They come here to our offices and bring all the paperwork. They have to bring documentation to demonstrate that the taxi is [fully licensed and] legal, that they are able to drive the taxi, and that they have no criminal record. This documentation is the operation card, the taxi card, their driver's licence, national ID, and the [obligatory accident insurance].* (Easy Taxi manager 3)

Operational regulation of drivers' actions was undertaken – often algorithmically – formally and objectively by the platform. Given EasyTaxi's dominant market position, drivers no longer had the option of cleaning their records by quitting and registering with a different platform as they could potentially do with TOCs. So driver behaviour became more tightly constrained than previously.

In terms of discourse, there was a shift towards more positive framing: not just EasyTaxi's press releases finding their way into the media but the positive reactions of drivers and passengers towards the app. International travellers, for example, continuously recommended use of EasyTaxi as a way to stay safe in Bogotá. However, reflecting the legacy of the old regime either in the perception or reality of relations, negative sentiments were not far from the surface: an EasyTaxi senior manager describing taxi drivers as "gang bangers and very quarrelsome"; passengers complaining about continuation of poor practices such as bad driving and overcharging; and drivers concerned that EasyTaxi could be as monopolistic as the TOCs.

This last point reflects a broader issue of what did <u>not</u> change. Uber requires a complete change: new vehicles, new licensing, new driver selection, etc and runs a dedicated and stand-alone service. But EasyTaxi worked with and did not require change to, many of the features of the pre-existing regime. Regulatory oversight remained the same: EasyTaxi itself might be ICT Ministry-regulated but taxis and drivers using the app remained under the jurisdiction of the same and various transport-related government agencies. Owners and drivers remained the same. And, by allowing drivers to use EasyTaxi as one of multiple booking systems, even TOCs were not head-on excluded. Indeed, affiliation to a TOC remained an operational requirement for drivers and was the only explanation for their continuing existence. Just that, like the boiled frog, they were being slowly weakened and in time were likely to be superseded.

Analysis and Discussion

We will deal in turn with growth of the platform and then with its impact.

This platform rapidly scaled – and thus had a significant impact – because of incentives to adoption that were first understood in the narrative above as problems located in two elements of the MLP. Within the broader landscape, there was pressure of growing urban mobility arising from rising population and rising incomes. Within the pre-existing regime, this pressure met a cap on licences to create dissatisfaction with taxi services particularly among Bogotá's middle classes. Colombia's landscape of poverty and unemployment provided a ready supply and ready substitutability of taxi drivers. Interacting with an oligopoly of taxi operating companies within the regime, this led to poor managerial treatment of drivers and a dissatisfaction with that treatment. Interacting with over-competition for fares within the regime, this led to poor standards of service for passengers, exacerbating their dissatisfaction. Finally, Colombia's landscape of instability and criminality mixed with features of the regime to create insecurity for drivers but particularly for passengers. The growth of this platform has been driven by its utility for two key groups – drivers and passengers – in addressing these dissatisfactions and fears.

Growth of this platform was also shown to require a set of enablers. There was effective handling within the implementation process of potential barriers: selecting the right routines to digitise into the app, accelerating the diffusion of smartphones among drivers, informal training and awareness processes that diffused skills and knowledge, regulation as a digital not transport company, and ineffective or neutered competition from incumbents and other platforms. The right digital and telecommunications infrastructure also needed to be in place.

Given the platform's rapid scaling and growth in market share to a dominant position, it has had an important impact on the market. We can summarise this as shown in Table 2, based on the four elements we coded for both the pre-existing regime and the regime transition.

Table 2 Platform impact as regime transition

	Pre-Existing Regime	**Regime Transition**
Routines	Manual booking and journey process Cash payment flows Use of radio for assistance Poor driver behaviour Criminality	Booking and journey process formally inscribed into app Cash payment flows Use of radio for assistance Improved driver behaviour New data flows and use for booking and management New phone-based mapping and communication
Resources	Value/scarcity of phone numbers and radio licences Value of driver radios Some GPS use Ready substitutability of drivers Financial resource pressures	New data Less value of phone numbers and radio licences Value of driver radios GPS abandoned Driver-owned phones
Relations	Value of TOC regulator contacts Informal driver groups Poor TOC--owner--driver relations	Less value of regulator contacts Informal driver groups New platform--user relations Poor TOC--owner--driver relations
Institutions	Insecurity and mistrust TOC oligopoly Weak unions and law enforcement Risk loaded onto drivers	Greater security and more positive discourse but still mistrust TOCs weakened Platform market dominance Formalisation of driver regulation

From this, we can already identify three impacts associated with introduction of this platform, and which fit with the three specific features of developing country contexts earlier identified. First, and focusing on changes in resources, there has been growth and re-distribution of technology and capabilities. Most notably, though, there has been datafication, with the capture, storage and analysis of digital data about many aspects of personal transportation that was previously lost in the ether or at least the value of which was not being captured. Two other impacts flow from this datafication and link specifically to the broader patterns seen in earlier literature. There has been a formalisation of some processes; particularly the before, during and after of passenger journeys, and some aspects of the management of drivers. This can be contrasted with the institutional informality of many of these processes under the pre-existing regime.

One can also see some shifts in power as a result of the platform's introduction. Passengers have been empowered to some extent thanks to the new data flows which help address the previous informational uncertainty and nescience which had fed fear and insecurity about travel in Bogotá. But the key change has been some transfer of power from the old taxi operating companies to the platform. Not merely due to the declining market share of the former and the loss of value of the resources they control. But also due to the significant value of the data the platform

now owns, the transfer of responsibility for driver management to the platform's algorithms, and the more positive discourse that circulates about EasyTaxi.

One potential impact on power and social relations did not emerge. Although they have been happy with the platform to date, the position of drivers has not changed much in terms of power. Through their support groups and use of the radio, they have acted to resist some potential loss of power to the platform. However, the emergence of EasyTaxi as a virtual monopoly in the app-booking market is a threat, with potential for "Meet the new boss. Same as the old boss" in terms of the power to exploit drivers that has been seen in other markets.

Discussion

Comparing the individual elements exposed through the findings and analysis with those identified in Table 1 from prior literature, we find substantial similarities. The value of the multi-level perspective as a framework for analysing the development role of digital platforms does not, therefore, come from its exposure of some new factor that prior literature failed to identify.

Instead, the MLP's value as a framework comes first from its factoral and scalar holism. As shown above, prior literature and conceptualisations have illuminated individual aspects of platforms and development. By contrast, the MLP covers all three levels: the micro, meso, and macro. In simple terms, this means that it is more comprehensive; for example, in its coverage of development impact. But this is also a necessary holism. As shown in the analysis, the utility of the platform and hence its rapid adoption, growth and impact can only be understood if one understands the wider landscape, the pre-existing regime, and their intersection with each other and with the platform. Any more-constrained framing could not provide an appropriate explanation. The MLP has also been more than merely aggregative in revealing all of the factors of relevance. It has exposed how interactions between these factors have, for example, underpinned growth: how technology intersects with incentives, how resources intersect with social relations, how demographics intersect with regulation, etc. To repeat, this is not just a useful aggregation, it is necessary to understand the development role of platforms.

The MLP's value also comes from its longitudinal holism: its understanding of the introduction of digital platforms as socio-technical transitions; that is, as an interaction between a new socio-technical innovation and an existing socio-technical regime. This contrasts with the perspective of the great majority of literature to date which has under-represented prior context, especially the systems that pre-exist and compete with platforms. Yet, as can be seen from the analysis, the MLP's perspective is needed in order to understand the development impact of platforms. Development impact of any technology – platforms included – must be understood as a process of change; as a difference between what was and what is. The impacts identified – changing distribution of technologies and capabilities; value of new digital data; formalisation of processes; shifts in power; etc – can only be understood in these terms; can only be understood through a framework that analyses the before and after of the platform.

This longitudinal view that a transition perspective provides was also essential in order to understand that the platform's impact was to create a hybrid transportation regime in Bogota; one that mixed the old radio-based, TOC-dominated regime and the new app-based, platform-dominated regime. Not only would this hybridity per se have not been exposed without the transition perspective but neither would its cause. That, first, this was a hybridity of design. EasyTaxi was able to grow because it designed change to be an incremental rather than discontinuous shift from the content of the pre-existing regime; for example, working within existing regulations and processes such as metered fares. Second, that this was a hybridity of choice shaped particularly by the context of insecurity and mistrust that has pervaded transport in Bogotá: drivers continuing rental and use of radios; continuing strength of informal driver groups; even design decisions like the provision of an EasyTaxi call centre for passengers.

The MLP has also been longitudinally holistic in the sense that it provides a longitudinal picture of digital platforms, incorporating both implementation and impact. As with coverage of the three levels of analysis, this has an aggregative value: it tells the whole story of the platform in a way that the past literature and framings have not. But it has also shown the necessity of this broader perspective, because of the intersection of implementation and impact. Generally, this is foundational to any understanding of development impact because user adoption and hence growth of a platform's user base determine the size of impact. Specifically, particular features of implementation such as the ongoing role of radios and taxi operating companies or emergent uses of smartphones shape the nature of impact.

Lastly, the MLP was shown to have other values. When dealing with implementation and potential growth of platforms in developing countries, the past literature tended to focus on enablers and constraints. The MLP-based analysis encompassed this, revealing the implementation factors and domains (technical, individual, systemic, contextual) that were individually familiar from past literature on platforms and developing countries, including the type of resource and institutional constraints typical of development contexts. However, in addition, it has shown that rapid growth of this platform was best understood in terms of incentives: the driving forces behind user adoption and platform growth. This conceptualisation has shown that these need to be placed more centrally than was the case with prior literature because of their core explanatory role. While enablers and constraints may help explain the speed and extent of platform growth, the central impulse to that growth can only be understood via analysis of adoption incentives.

Conclusions

Growth of digital platforms in developing countries has not yet been matched by growth in development research on this phenomenon. The key contribution of this paper is to present and apply one framework that could provide the conceptual foundation for such research. This has demonstrated the relevance of

understanding platforms in development settings as socio-technical transitions, and analysing them using the multi-level perspective; as technological niches that intersect with and change existing socio-technical regimes within a contextual landscape.

In applying the MLP for the first time to analyse a digital platform in a developing country, we found some issues with the framework. Beyond the core concepts of landscape, regime, niche innovation and transition, the MLP can be seen as something of a blank canvas; attuned more to narrative story-telling than to systematic analysis. Thus, for example, our incorporation of elements such as the four regime components and their association with the constitution of power have been particular choices rather than inherent to the framework. Likewise, the generic nature of transitions means that any particular features of platforms such as network effects or platform infrastructures must be inserted. The MLP's breadth of coverage also means that depth of insight into any particular issue was limited: this would not be a conceptualisation to use if seeking a comprehensive understanding of, say, incentives to adoption or the reconfiguration of power.

In addition, the MLP-based analysis did not throw up any individual factors completely unknown from past literature. Instead, its originality and value came more from its holistic conceptualisation of platforms and development. This enabled a relatively-complete understanding of the development role of platforms and engagement with a number of issues central to technology-and-development research: the process of innovation, adoption and scale-up of the technology, and micro- and meso-level impact. Through its comprehensive coverage of individual, systemic and contextual factors, MLP-based analysis has been able to encompass and explore all the factors together rather than just a sub-set, including those of specific relevance to developing countries. It was thus able to expose the interaction between factors and levels in a way that past work has not. Full analysis of development impact was possible because the MLP encompassed both comparison and interaction with existing systems; something which has, respectively, been rare or absent in analysis to date. By enabling simultaneous analysis of growth and impact, there was none of the artificial separation seen in literature thus far so that, for example, impacts of datafication and formalisation could be understood as providing utility that encouraged user adoption of the platform. In all this, use of the framework advanced an argument that digital platforms not only can but need to be understood by development researchers as socio-technical transitions.

Generalising applicability of this conceptual framework from a single application must be cautious. However, understanding digital platforms as socio-technical transitions analysed at the three levels of niche, regime and landscape appears to be a useful – and arguably necessary – new basis for analysing implementation, adoption and impact of digital platforms in developing countries. Its analysis would help not just development researchers but also platform strategists to understand growth drivers and enablers, and policy-makers to understand platform impacts.

Future development research can seek to apply the framework to other examples of digital platforms in developing countries. This could include application to platforms developed in their original markets: the level of insights into the original niche innovation was limited here because our case focused on the platform's second-wave market in Colombia rather than its original market, Brazil. This could also include assessing the extent to which features seen here – the push-and-pull drivers arising from intersection of landscape, regime and platform innovation; the types of enablers; the types of impact relating to datafication, formalisation and power – are found more broadly in developing countries.

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