Introducing Platform Ecosystem Resilience: Leveraging Mobility Platforms and their Ecosystems for the New Normal during COVID-19

COVID-19 has created many constraint-related challenges for humans in general and organisations in particular. Specifically, businesses that require physical contact, such as mobility providers, have been severely impacted by the crisis. This paper reveals how mobility platforms and their ecosystem of actors have adapted faster than their non-platform competitors to become resilient. Whereas current research on resilience explicitly deals with the concept of organisational resilience, community resilience, or IT resilience, socio-technical characteristics of digital platforms have not been investigated. We build on a case survey approach, including heterogeneous qualitative evidence of 266 actions of 171 analysed mobility platforms. The results show five archetypes of how mobility platforms leverage their platform-based nature and the ecosystem to build resilience. Based on this, we develop the concept of platform ecosystem resilience as leveraging socio-technical factors of digital platforms and ecosystems frugally to design, deploy and use situation-specific responses to prepare for, endure and adapt by capturing new opportunities and engaging in transformative activities to cope with exogenous shocks and become resilient for future disruptions. Our results emphasise the importance of platform ecosystems for practitioners and policy planners to develop the "new normal" rather than resuming existing practices.

Keywords: resilience; platform ecosystems; mobility platforms; COVID-19

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Introduction

Never in modern times, and in such a short time frame, have the great majority of industries and societies faced a severe exogenous shock as COVID-19. The pandemic has brought unprecedented adverse effects to human healthcare systems, the economy,

and social life. Driven by the need to dampen the exponential growth of the virus, governments have had to impose lockdowns and severe contact restrictions (UK Government, 2020), which have put enormous pressure on cities and communities, as both businesses and private institutions have had to adapt to these conditions.

In particular, these restrictions have severely impacted mobility platforms. By offering physically shared assets, digital matchmaking, and real-world interactions (Trenz et al., 2018), mobility platforms are exposed to constraint-related challenges in the physical world (Constantiou et al., 2016) and a dynamic and competitive digital environment. For example, real-world interactions and shared physical assets stand counter to social distancing requirements and the fear of infection (Hertzke et al., 2020). For this reason, mobility platforms have experienced adverse effects: spending on ride-hailing and bookings of electric scooters fell significantly (Leatherby & Gelles, 2020), and some operators had to pull out of certain cities (Bliss et al., 2020). Furthermore, the ever-growing number of private mobility platforms participating in the market (Lang et al., 2019) have had to compete for a reduced set of resources (such as customers) because of the pandemic. This effect has been accelerated as large areas of cities were made car-free to encourage walking and cycling (Taylor, 2020).

Despite the drawbacks of COVID-19, some mobility platforms have not only been resilient enough to survive the crisis but are thriving. For example, GoTo Global, GreenCar, and Meituan (formerly Mobike) have reported significant increases in users and trips (e.g., Laser, 2020) and already exceeded their set pre-lockdown business objectives of growth and profitability (Lunden, 2020). Mobility service platforms have capitalised on their platform-based nature to respond to the crisis. Some ride-hailing providers have opened up their digital platforms to local public authorities by offering a wide range of digital features. These include trip planning, real-time tracking, and

navigation of vehicles to optimise the delivery of emergency logistics (e.g., ViaVan, 2020a) or to enable the creation and display of routing options, taking social distancing requirements for public transportation use cases into consideration (e.g., Spare, 2020).

Furthermore, mobility platforms have utilised their platform ecosystem to pivot out of the crisis-related limitations and become resilient: the peer-to-peer (P2P) ride-sharing provider "BlaBlaCar" has successfully introduced a new platform through which communities can support one another with grocery shopping during COVID-19. Not only did 20,000 people register within 72 hours, but the mobility platform subsequently experienced a significant increase in summer holiday bookings via its platform (McLaren, 2020). The new community platform, complemented by actors of the ecosystem, even led to positive cross-platform effects, which, in turn, gave rise to a level of bookings exceeding the pre-crisis level for certain travel destinations.

Research shows that the concept of resilience has proven useful in overcoming exogenous shocks such as COVID-19 (e.g., Rapaccini et al., 2020; Sakurai & Chughtai, 2020). However, research on resilience has not reached theoretical convergence; nor is there an understanding of how resilience can be built through the interplay of digital platforms and the ecosystem. Different research streams of resilience have developed isolated definitions, theories, and understandings in different contexts and on different levels (Linnenluecke, 2017). For example, research on the organisational scope of resilience (e.g., Urciuoli et al., 2014) falls short in accounting for the large set of opportunities that comes with platform ecosystems (Hein et al., 2020). On the contrary, the stream of community resilience (e.g., Hamann et al., 2020) does not account for the organisational level of resilience. Recently, there have been calls for papers to tackle the research gap in understanding resilience using information technology (Boh et al., 2020; Sakurai & Chughtai, 2020). Digital platform ecosystems represent a novel context

showing that the socio-technical factors of the technical platform and its social ecosystem can be combined to develop resilience. Therefore, we explore the following research question:

How can digital platforms and the ecosystem be leveraged to develop resilience during the COVID-19 pandemic?

We follow the case survey method (Larsson, 1993) by applying the Eklund and Kapoor (2019) approach to analyse the announcements of mobility platforms regarding actions taken to cope with the pandemic. We reveal five archetypes of platform ecosystem resilience and derive the first conceptualisation of platform ecosystem resilience. The five archetypes represent patterns of how digital platforms can leverage the socio-technical factors of both the platform and the ecosystem to become resilient in the short and medium terms. We demonstrate that resilience is built frugally, socio-technically and contributes to a transformative "new normal" instead of "preserving the past," or leaping back to a pre-crisis state. The archetypes influence resilience on different levels, ranging from the platform owner's organisational resilience to the ecosystem resilience of complementors, to community resilience on a societal level.

Theoretical Background

The concept of resilience has been a prominent and emerging topic in various disciplines such as ecology, psychology, engineering, management, and information systems (Müller et al., 2013). Resilience originated at the individual level from social psychology, denoting positive engagement with internal failures, weaknesses, deviations, or impacts as they become apparent (Sitkin, 1992). Resilience has been adopted at different levels of analysis, such as the organisational, group, and community levels (Taani & Faik 2019). As platforms orchestrate an autonomous ecosystem of

actors through socio-technical means (McIntyre et al., 2020), the concepts of IT, organisational, and community resilience need to be considered. Moreover, we outline extant research on resilience in the context of a crisis as an exogenous shock, as the latter serves as a useful conceptualisation of the ongoing COVID-19 situation.

IT Resilience

Research on IT resilience is manifested as a capability of a system itself. Examples are an information system's ability to anticipate risk and avoid potential losses (e.g., Hollnagel et al. 2006) and quickly recover from disturbances (e.g., Haimes et al., 2008). As part of organisational resilience, IT has been investigated from a backwards-oriented perspective by referring to resilience as the maintenance of system properties (Leveson et al. 2006), core practices and goals (Walker & Salt, 2012), a rebound of a system to its original state, or a continuation of its mission despite disruption (Müller et al. 2013). Although the nature of COVID-19 heralds the need to develop resilience on a broader scale (e.g., society, organisations), only a few papers explore how information systems affect the resilience of a higher-level system. For example, the extent to which the use of ICT supported a set of ecological literature-derived resilience attributes applied to social communities has been investigated (Heeks & Ospina, 2019). This high level of abstraction, however, falls short in explaining organisational resilience building. This is aggravated by the lack of any empirical investigation that includes real-world examples of how IT can be used to build resilience. Our study goes beyond the traditional IS focus on how strong the "sword" (IS system) is, but to investigate how the "sword" (here: digital platform) can be used to build resilience. Moreover, despite two exceptions (Sakurai & Kokuryo, 2014; Sakurai & Chughtai, 2020), the literature on IT resilience does not account for exogenous shocks such as COVID-19.

Organisational Resilience

On an organisational level, resilience has evolved from responses to external threats (Staw et al., 1981), to resilience as reliability (Weick, 1993), adaptable business models (Sutcliffe & Vogus 2003), and design principles to reduce organisational vulnerabilities (Gittell et al., 2006). The focus has shifted toward an internal perspective of resilience, dealing with the reliability of processes and avoiding failures (Linneluecke, 2017).

Later, the concept of adaptability and focus on external events was revisited. An organisation's ability to adapt to overcoming an immediate situation of adversity includes the development of flexible resources (Dierickx & Cool, 1989). Resilience can be achieved a priori by sensing and preparing an organisation for unknown threats or a posteriori by responding to identified threats. Building a priori resilience constitutes a continuous process of sensing for example, constant renewal (Wastell et al. 2007) or detection of drifting toward failure (Dekker, 2006). In turn, a posteriori resilience refers to a more recent stream of research that focuses on detecting a threat and activating an organisational response (Burnard & Bhamra, 2011).

When responding to external threats, firms can be backward- or forward-oriented. Backwards-oriented actions mean "bouncing back" to a previously existing "shape" (Sutcliffe & Vogus, 2003) and restoring normal operations of its essential structures and functions (Rice & Caniato, 2003). Forward-oriented actions, meanwhile, bring renewal beyond mere "adaptation" and rebound to the centre of resilience (Hamel & Valikangas, 2003). Forward-oriented actions refer to a proactive way of dynamically responding to situations. Examples are transforming (Walker & Salt, 2012), developing a new identity (Wastell et al., 2007), or capturing new opportunities (Hamel & Valikangas, 2003). This stands in contrast to returning to an original state that was unable to cope with the

immediate shock in the first place (Sakurai & Chughtai, 2020). Thus, the forward-oriented, transformative role of resilience is thus greatly under-investigated.

Community Resilience

Research on resilience also focuses on communities as social groups that prepare, respond, and recover from crises that challenge their social, political, or economic stability (Lee et al. 2013; Adger, 2000). Community resilience is "the ability of community members to take meaningful, deliberate, collective action to remedy the effect of a problem, including the ability to interpret the environment, intervene, and move on" (Pfefferbaum et al., 2007). The current literature shows the first indications that ecosystems, like communities, might also be important as a factor influencing resilience. For example, the interference of strategic social and environmental business practices, e.g., through interdependencies with diverse actors (DesJardine et al., 2019), as well as self-organising ecosystems and their impact for necessary social service provision (Belso-Martínez et al., 2020), has been investigated.

Resilience in Times of Exogenous Shocks/Crises

The nature of the involved threats can be a minor interruption or severe disruption resulting from exogenous events (Linneluecke, 2017). We follow the latest research and conceptualise the COVID-19 pandemic as disruptive (Sakurai & Chughtai, 2020) for the following reasons. It has been challenging to prepare for the pandemic (Gephart et al., 2009), collectively experienced immediately due to sudden outbreak (Kaniasty & Norris, 1993), and this has had a global impact (Oh & Oetzel, 2011), with significant effects for both business and society (McEntire, 2015). As it was difficult to foresee, leading to radical socio-economic effects, this pandemic comes with a high level of

complexity and uncertainty concerning the situation before, during, and after the initial outbreak.

The concept of resilience has already been investigated in the context of exogenous shocks, including recent resilience studies in COVID-19 (e.g., Sakurai & Chughtai, 2020). Here, the focus is on resilience at the organisational or wider system level, such as community members or society. For example, it has been investigated how organisational resilience is manifested through the severity of loss and time to recovery (DesJardine et al., 2019). Considering the impact of the concept on a wider level, local community members' resilience through venture creation (Williams & Shepherd, 2016) and emerging social response networks (Belso-Martínez et al., 2020) have been investigated. However, there has not been a joint investigation of the two concepts, which might be worth considering, especially in the platform ecosystem context.

As the pandemic triggers multilevel effects (Sakurai & Chughtai, 2020), not only the technical design features of the IT system but also their combination with organisational and social features of the ecosystem that contribute to resilience and a "new normal," are needed. Although some research has already acknowledged the socio-technical character of resilience by outlining the potential contribution of technical attributes to organisational benefits such as decentralised decision-making (Müller et al. 2013), it falls short of understanding ecosystem-related factors as an influence on resilience in times of crisis. Moreover, we follow Sakurai and Chughtai (2020) and conduct our research beyond the mere concept of a system's resilience by empirically investigating how digital platforms can contribute to resilience on a broader scale. We build on the first indications of literature that show ecosystems as influencing factors and the level of impact as a gap in information systems research.

Method

We followed a case survey (Larsson, 1993), inductively deriving the socio-technical characteristics of mobility platform ecosystems and their ability to respond to the outbreak of COVID-19. The case survey method facilitates learning from a large amount of heterogeneous qualitative evidence represented by case studies. Case surveys further enable aggregate reviews of individual cases (Yin & Heald, 1975) and allow for cross-case identification of patterns without compromising scientific rigour (Larsson, 1993). By inductively coding responses to the crisis and how mobility platforms could recover, we followed the spirit of current research to contextualise resilience in a novel way (e.g., Heeks & Ospina, 2019).

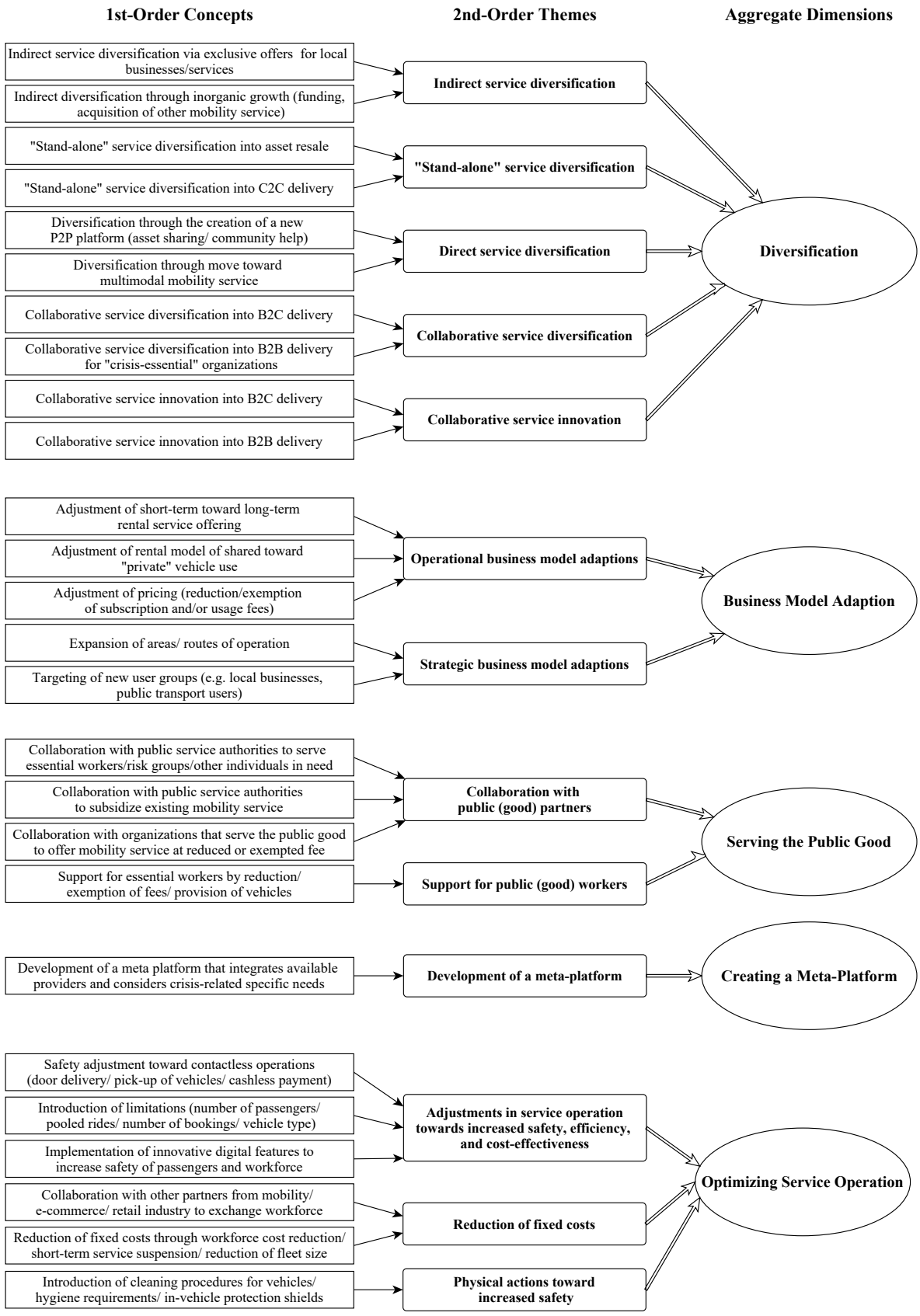
As our goal was to enquire how resilience is developed in the context of digital platform ecosystems, we followed the process suggested by Eklund and Kapoor (2019) and collected announcements showing how mobility platforms have coped with the pandemic. Announcements included social media channels, application updates, websites, news sources, and other types of practitioner-oriented outlets, as research articles addressing the pandemic are still sparse. Our data collection took place between February 2020 and the end of August 2020, covering the pandemic's first global outbreak. With our initial sample, we included a vast majority of mobility platforms and announcements. We included every provider related to shared mobility services that we could find based on the Crunchbase list of European and worldwide mobility-related firms, finishing with a total of 577 platforms. By iteratively running a manual search by scanning their websites, social media posts, and third-party information for relevant announcements, we found a total of approximately 1,500 announcements. Although in our study, in the context of digital platform resilience, the focus of our data collection has been more on the "respond" and "recover" phase after the first wave of COVID-19

(a posteriori), we did not want to exclude any long-term effects of the platforms' responses that could help them to continuously adapt and be "prepared" before (a priori) the second wave of this turbulent event. A detailed screening of the actions concerning the relevance of COVID-19-related response mechanisms yielded a final sample of 266 relevant individual actions by 171 mobility platforms (= cases). We included every announcement related to responding actions to the pandemic of the mobility platforms. We excluded duplicates and irrelevant announcements, for example, announcements relating to pre-crisis achievements such as an increase in rides in the earlier months. This shows that not every mobility platform has carried out actions to cope with the pandemic.

We took a systematic inductive approach to data analysis and iteratively compared our data with the emerging concepts (Miles et al., 2014; Corbin & Strauss, 2008; Locke, 2001). Two authors coded the cases following a three-step coding approach—open, axial, and selective coding—as proposed by Strauss and Corbin (1990).[1]

[1] Appendix A shows details on the coding process which resulted in the final data structure for each of the five archetypes as illustrated in Figure 1.

Figure 1. Overview of final Data Structure



Findings

The case survey reveals the five platform ecosystem resilience archetypes of diversification (AT1), business model adaptation (AT2), serving the public good (AT3), creating a meta-platform (AT4), and optimising service operation (AT5). Each archetype utilises platform- and ecosystem-specific properties to cope with the structural changes introduced by COVID-19 (see Table 1).

Table 1. Platform ecosystem resilience archetypes

	Platform Ecosystem Resilience Through				
	AT1: Diversification	**AT2: Business Model Adaptation**	**AT3: Serving the Public Good**	**AT4: Creating a Meta-Platform**	**AT5: Optimising Service Operation**
No. of actions	42 (= 16%)	29 (= 11%)	101 (= 38%)	2 (= 1%)	92 (= 35%)
Description: measures that contribute to	Direct or indirect service diversification, with the majority involving new complementors and a new type of user	Adaptation of the business model, including adjustments in terms of channels, revenue streams, or value propositions	Collaboration with public service authorities or other companies of the mobility service industry to serve persons in need	Collaborative development of a joint platform that integrates available mobility service providers	Adjustments toward a safer, more efficient and cost-effective service operation
COVID-19 nature	Drastically reduced transport, production, and consumption	Changed customer requirements and altered consumption patterns	Public-private initiatives surged to achieve a common goal (public good)	Demand for the development of support networks between different organisations has surged	Need to limit the provisioning effort for continued service delivery "as little as possible, and as much as necessary"
Usage of the platform	Modular architecture	Platform externalities, speed of platform development	Matchmaking mechanisms, private-sector platform capabilities	Information aggregation as platform broker	Operational innovation on the platform
Usage of the ecosystem	Diversity of actors and the innovation strength of the individual ecosystem actors	Internal and external information about the existing installed base (customers)	Technological modularity of the ecosystem, the public-sector ecosystem as a business opportunity	Multiple isolated successful service offerings of individual providers	Ecosystem as a resource

AT1: Platform Ecosystem Resilience Through Diversification

The first archetype covers 42 mobility platforms that diversify their service portfolios, building on mobility platforms' modular architecture and the variety of ecosystem actors. Government policies (e.g., closed borders or social distancing) have drastically

reduced transport, production, and consumption. The modular architecture of mobility platforms has enabled non-platform firms to extend or re-configure existing platform services. Most mobility platforms have extended service offers from individual mobility to delivering essential (e.g., groceries, medicine) and non-essential supplies (e.g., items from local shops, prepared food from restaurants and cafés). The variety of ecosystem actors further enables mobility platforms to diversify. For example, local restaurants and cafés have switched from eat-in to take-away or delivery-only meals. However, many of these "non-essential" businesses lacked the technological (e.g., smartphone application) and operational (e.g., ready-to-scale delivery processes) capabilities, as well as assets (e.g., vehicles and drivers), needed for this transition. Consequently, other firms cooperated with mobility platforms as a relatively easy and quick-to-implement "turnkey" solution. For example, the technology provider Autocab created the new service "Delivery Point," which enabled non-mobility firms to offer an individual delivery service with local taxis (Smith, 2020).

Mobility platforms use their modular architecture when adapting their existing service processes (e.g., individual mobility) to a new service type (e.g., delivering goods). The modular architecture contributes to resilience, as existing platform services can be re-configured or extended without significant effort. For example, the autonomous driving start-up Pony.ai repurposed its autonomous vehicle fleet for goods delivery with a new complementor, the e-commerce site Yamibuy (Ludlow, 2020). Yamibuy automatically assigns orders for groceries to the mobility provider's vehicles, and the packages are then delivered directly to customers with almost no customer interaction.

Mobility platforms of this archetype gain resilience using the ecosystem by amplifying their innovative potential through the diversity of actors and the innovation strength of the ecosystem. Users can rapidly shift from merely being consumers of the mobility

service to offering complementary services. Besides, the ecosystem actors can offer their unique resources and capabilities, such as cooking skills (with restaurants as new complementors), in combination with mobility services, to overcome physical contact restrictions. Thus, both the platform and the complementor gain resilience. Besides, complementors can innovate and co-create value with the platform. Helbiz, for example, partnered with Italy's largest health products supplier, eFarma.com, to offer same-day delivery of COVID-19 safety kits (Spriano, 2020). Hence, platforms are not limited to their value creation but can utilise situation-dependent complementors to diversify their service offerings.

AT2: Platform Ecosystem Resilience Through Business Model Adaptation

A total of 29 mobility platforms of this archetype have adapted their business models by exploiting platform externalities and customer information from the ecosystem. Mobility platforms harness the scale and implementation speed of digital technologies to quickly implement short-term adaptations to their business models (focal mobility service). These can be withdrawn whenever circumstances call for normality. With COVID-19, these business model adaptations are triggered mainly by changing customer requirements and altered consumption patterns. For example, office closures led to different commuting behaviours, creating a changed demand toward longer rental periods of various mobility-sharing services. Mobility platforms of this archetype adapt their business model to incentivise users to use the service despite the changed conditions. The resulting increase in service bookings can counteract the changed customer behaviour and contribute to resilience. For example, several providers, such as Yulu, Bounce, or SPIN, have started to offer long-term rental plans (e.g., weekly or monthly rates) in addition to their short-term rental models (per-minute or per-hour pricing) (Bounce, 2020; Yulu, 2020a; Spin, 2020). Thus, the scale of platform

adjustment helps mobility service platforms to easily adjust their business models to all customers in a scaled manner and at short notice as well as to undertake actions with a potential long-term impact on their existing services.

By adapting the business model, this archetype capitalises on platform externalities and speed of platform development to contribute to platform ecosystem resilience. For example, a large majority of providers quickly applied for short-term reductions or exemptions from subscription or usage fees within their mobile applications in the very first stage of the pandemic, between March and April 2020. For example, Whim App and GoVolt introduced short-term price reductions during the "first wave" of COVID-19 (Whim, 2020; GoVolt, 2020). By implementing exclusive pricing for certain groups, mobility platforms are also targeting new types of user: CityScoot offered discounted minute packages to employers (Cityscoot, 2020), which could then be transferred to employees. Building on platform externalities, the newly created services can scale, having reached a critical mass, and they have the potential to grow significantly.

Alongside the internal information from the ecosystem stored on the platform (e.g., aggregated customer-service-usage behaviour), mobility platforms can use additional external information from the ecosystem of actors. For example, knowledge about changed commuting needs (e.g., from customers calling the mobility platform; Frank, 2020) enables operators of mobility platforms to sense opportunities early and adapt existing services accordingly. Hence, mobility platforms could target additional short-term revenue streams as the crisis surfaces previously unseen demands. For example, Blade has introduced a limited amount of "Commuter Passes" for exclusive helicopter services from the Hamptons to New York for the first time (Davis, 2020). With increased office closures and work-from-home arrangements, the demand changed from weekend trips to houses in the Hamptons, to users living in the Hamptons and

commuting to the city on an occasional basis. The passes sold out in less than 24 hours. Consequently, the stimulus of the ecosystem on the mobility platform contributes to platform ecosystem resilience by endorsing business model adaptation.

AT3: Platform Ecosystem Resilience by Serving the Public Good

This archetype covers 101 mobility platforms that build on platform matchmaking mechanisms and the technological modularity of the ecosystem, as well as the longevity and stability of the public sector. Mobility platforms collaborate with public service authorities (i.e., city governments, public transportation), humanitarian or public health-care organisations, local NGOs, or other companies of the mobility service industry to create joint initiatives. The COVID-19 pandemic affects both public and industrial corporations. Consequently, the new situation cuts across different policy areas and allows for the previously unseen public-private initiatives to jointly achieve public goals. Axon Vibe and its newly created "Essential Connector App," for example, combine public and private transportation to help New York's essential workers to move during nightly subway closures (Hawkins, 2020). The combination of the entrepreneurial spirit of private platforms and the longevity and stability of the public mission facilitates the creation of new services in the short term and alliances that might last beyond the pandemic.

Mobility platforms orchestrate a variety of autonomous actors. The matchmaking mechanisms of mobility platforms can build new alliances between formerly unconnected and unrelated suppliers and users. For example, the ride-hailing provider Gett identified DKMS, the German stem-cell non-profit company, as a potential partner at an early stage and offered a seamless service so that donors can book their free on-demand ride as soon as they arrive in the designated city to ensure a seamless journey to

the hospital (DKMS, 2020). The example also illustrates that the modular design of mobility platforms allows actors to access, deploy, and co-innovate based on resources provided by the mobility platform. These resources can then be integrated by public authorities, who often lack the technological capabilities to serve a common good to a crisis-necessary extent, such as functioning health-care or critical infrastructure systems. Simultaneously, these allow partners to implement new innovative features, such as safe last-mile connections, automated dispatching, user personalisation, and passenger capacity planning respecting social distancing requirements. For example, several technology providers have opened their platforms up to existing public transportation systems and health-care organisations to let authorities to establish additional flexible on-demand services, as in the case of Spare and ViaVan (ViaVan, 2020a; Vik Hansen, 2020). Apart from creating additional opportunities for the platform, this might lead to intensive joint service innovation projects in the future.

Next to platform-specific factors, the ecosystem's technological modularity adds to the ease of integration of services and features. For example, Routable AI adapted its digital technology from vehicle dispatching to efficiently allocate beds for homeless people suffering from COVID-19 in Boston Health Care hospitals (van der Zee, 2020). It also connected its in-house optimisation tools with the hospital-owned ambulance-dispatching platform to directly transport patients to their assigned beds. Complete access to actors' ecosystem as potential complementors for (public) organisations offers several opportunities for collaboration. Many mobility providers directly support essential workers, risk groups, or persons in need. BIXI offered a free 30-day subscription to all employees of Montreal's public health and social service institutions (BIXI, 2020). These examples illustrate how mobility service providers offer alternative transportation modes to essential and safe options for getting from A to B. In all, we

found that private mobility platform providers benefit significantly from public-sector ecosystems, which provide mobility platforms with business opportunities and thus, survival assistance to continue running their businesses during COVID-19.

AT4: Platform Ecosystem Resilience by Creating a Meta-Platform

This archetype includes two mobility platforms that build on information aggregation as a platform broker to develop a meta platform. These meta platforms aggregate available mobility service providers, public transport, and other services into a one-stop-shop with a standardised front-end for mobility options allowing for inter-modal routing algorithms with social distancing as a prioritised parameter. Interestingly, this centralised action has been initiated not by focal mobility platform ecosystem leaders but by Tier-1 technology providers. As COVID-19 has negatively influenced the mobility ecosystem, mobility providers have faced significant restrictions and existential threats. This has unleashed a social "all-in-the-same-boat" situation, in which helping one another can potentially compensate for adverse events. Consequently, demand for the development of support networks between different organisations has surged. It has become essential for a central actor to step up efforts to provide a means for organising collective action. In this way, the ecosystem profits the meta-mobility platform owner, with other providers being dependent on them as a broker. Examples include the "COvid-19 REsilielt Mobility as a Service" (CORE MaaS) platform of the providers Iomob Technology Services and Factual (UrbanMobility, 2020), as well as the newly created WeAllMove platform by a newly formed alliance, including different mobility providers, insurance companies, and the World Economic Forum (WeAllMove, 2020).

Information aggregation as a platform broker acts as an enabler of this archetype in three ways: first, individual providers mobilise to participate in the collective movement, as new complements can be provided as easily as possible through open APIs and SDKs. Second, the information flow into the meta platform is managed in a coordinated way. Third, it facilitates disseminating the information to mobility service users in a standardised and transparent manner. As a result, resources (such as the standardised booking front-end) can be easily shared within the mobility ecosystem, reduce costs, and enable individual providers to work toward common goals with mutual benefit. This contributes to platform ecosystem resilience, as the platform owner can pivot from a somewhat passive role in value creation (e.g., by providing intelligent routing systems to other platforms) to an active role in creating new solutions.

Mobility platforms of this archetype used the ecosystem to aggregate multiple isolated providers and services to develop a shared identification. This might reduce the unpredictable behaviour of individual actors and facilitate adequate coping responses compared to competitors. In total, the archetype possesses platform ecosystem resilience by leveraging the vast ecosystem collective.

AT5: Platform Ecosystem Resilience by Optimizing Service Operation

The last archetype involves 92 mobility platforms where a safety or resource usage adjustment to the operations of the mobility services was needed. Examples include the in-app set-up of no-parking zones in areas with a high risk of infection (e.g., Hellobike, 2020), the implementation of "last-sanitised" timestamps (e.g., Yulu, 2020b), and specific reward programmes to encourage individuals to stay at home (e.g., Hytch Rewards; Stone, 2020). This could be achieved by utilising the operational innovation of the mobility platforms and exploiting the ecosystem as a resource. As COVID-19 hit,

mobility platforms were confronted with drawbacks such as reduced service bookings and infrastructure restrictions. These drawbacks revealed the need to adjust the way of mobility service provision to sustainably continue service delivery. In doing so, mobility platforms of this archetype allow for an "as-much-as-possible" innovative selling proposition with "as-little-as-necessary" input, thereby contributing to resilience.

The creation of new value is achieved by focusing on new or established platform transaction processes (i.e., contactless) afforded by operational innovation on the platform: Yulu established door delivery and pick-up of vehicles (Yulu 2020a), and Careem enforces digital payments instead of cash (Careem, 2020). Additionally, platforms introduced new innovative operational features. For example, the technology provider Trafi and SkedGo implemented pandemic-adapted routing algorithms. These help users comply with social distancing requirements by disclosing crowding levels and alternative travel options (Trafi, 2020; SkedGo, 2020). Moreover, mobility platforms can also be used as a central lever to instantly optimise the physical service operations of their complementors. This includes, for example, hygiene requirements that call for daily temperature checks for chauffeurs (e.g., Blacklane, 2020), and increased vehicle cleaning (e.g., Eloop, 2020), which must be confirmed by the drivers. Furthermore, significant limitations regarding the service itself have been implemented. Lyft, for example, disabled pooled rides and offered only single-passenger rides (Hawkins, 2020). All new value propositions add to resilience, as mobility platforms gain a competitive advantage compared to other transport alternatives.

Mobility platforms took advantage of the ecosystem "as a resource" by repelling or adding modules (e.g., platform workers as complementors). For example, Bird cut 30% of its workforce (Dickey, 2020a), Zity completely suspended its service for ten weeks (Elizondo, 2020), and BiciMAD halved the fleet size of the bicycles in Madrid

(China.org.cn, 2020). However, the workforce can be exchanged within the mobility ecosystem, as the platform structure of most of the providers allows for collaborative, on-demand workforce lending: while Uber partnered with CloudTrucks to open up more income options for drivers to start transporting freight loads (Dickey, 2020b), Lyft referred drivers to jobs at Amazon (Statt, 2020). Exploiting the ecosystem as a resource allowed mobility platforms to absorb possible further deteriorations such as mass unemployment in the mobility industry.

Discussion

The COVID-19 pandemic has had severe negative consequences for many industries and public systems. While one option has been to fall into a state of "shock-induced numbness," the pandemic has also revealed that some mobility platforms are well-equipped to cope with the crisis. As an example, we show how mobility platforms have built on platform and ecosystem-related characteristics to build resilience. Surprisingly, those characteristics have strengthened not only their organisational resilience but also the community resilience of their ecosystem. Based on this platform- and ecosystem-induced resilience, we have identified five archetypes, and we conclude with a definition of platform ecosystem resilience.

Impact of Platform Ecosystems on Organisational Resilience

We discovered several aspects of how platform ecosystems influence organisational resilience. First, all five archetypes leverage the digital platform to strengthen their organisational resilience. For example, mobility platforms from the first archetype diversified their service portfolios and value propositions with transitions to food delivery, P2P community help, and asset re-sale. Those platforms helped local businesses to mitigate the consequences of contact restrictions by offering new ways of

interacting with clients. As a result, both the platform and ecosystem actors were able to transition from dried-up revenue streams to new sources. The flexibility and diversification provided by platforms not only increased the organisational resilience of the platform owner (Heeks & Ospina, 2019) but also the resilience of ecosystem actors (Shepherd & Williams, 2014).

Second, the adaptability of a system's outcome, such as the business model change (system as an interplay of platform and ecosystem factors), can achieve organisational resilience. This adds to the organisational resilience literature on information systems, which highlights the mere adaptability of the system (e.g., the platform) itself, such as a range of controls to manage perturbations (Barn & Barn, 2015).

Third, brokers and matchmakers have proven useful in minimising COVID-related challenges for the mobility ecosystem (AT4). These meta-platforms helped to organise collective crisis-intervention actions by facilitating interactions with ecosystem actors (Bimber et al., 2005). Although brokerage has recently been studied in the context of the COVID-19 response (Belso-Martínez et al., 2020), it lacks a theoretical anchoring in the organisational resilience literature. This study illustrates that meta-platforms (AT4) are essential actors and indispensable partners in the post-crisis response to match crisis-related complementors into one centralised pool, which effectively fosters organisational resilience.

Fourth, we identified perceived pro-social behaviour as a potential context-related complement to organisational resilience. For example, developing services targeted at serving the public good and addressing the crisis-related urgent needs of society (e.g., by providing safe options for commuting for health-care personnel) might be perceived as pro-social (AT3). These actions inform the sharing mobility platform's image and thereby open access to new customer groups. Like to the literature on post-disaster

ventures (Shepherd & Williams, 2014), these pro-social actions appear to serve a higher purpose. This positively influences the identity of individual providers from the viewpoint of customers and potential future partners (Lilius, 2012). Pro-social perceived behaviour might also benefit actions that could otherwise easily be seen as critical and thus damage the image of respective mobility platforms. For example, in AT5, using the ecosystem as a resource to flexibly shift the workforce presents a more ethical alternative to merely laying off employees, which permits for cost-saving without sacrificing the social reputation from a mobility service user perspective.

Impact of Platform Ecosystems on Community Resilience

First, the archetypes AT1, AT3, AT4, and AT5 reveal how mobility platforms can create community resilience. The resilience literature highlights that building trust and interdependence (Goldstein, 2012), and sharing knowledge and goals between actors, is crucial to building community resilience (Shepherd & Williams, 2014). However, we found cascading effects and highly intertwined actions where partners in the ecosystem indirectly support or subsidise one mobility platform's actions. Thus, the interdependence between the focal platform owner and ecosystem actors can lead to community resilience. For example, after the announcement by the car-sharing provider ZITY that it would offer a free service to health-care and Red Cross workers in Paris, two of its leading suppliers, Continental (for vehicle retrofitting parts) and Ridecell (for routing technology), reduced their pricing for the car-sharing provider (Ridecell, 2020). This contributes to community resilience, as not only can ZITY reduce the operational costs inherent in running its service, but this might also be a first move toward shared solidarity for a common interest, in this case, the post-crisis survival of mobility services. Another example is ViaVan: together with a local government authority, it launched an intelligent delivery platform for goods. This platform ensures reliable

routing and delivery of emergency food and supplies to more than 1,000 residents in London's Borough of Sutton. Volunteers receive all the relevant parcel information, including routing options through a mobile app. Customers no longer need to line up to receive this information, and drivers can complete more delivery trips. Residents in need also profit from ViaVan's technology, as the app notifies them in time, allows contactless delivery, and provides the ability to contact drivers (ViaVan, 2020b). In this way, ViaVan's action has positively influenced not only its institutional partner, Sutton Council but also providers of emergency food and supply, as well as individuals, both volunteers and persons in need. This underlines the idea that the impact of measures by shared mobility providers is multilevel and can positively contribute to the entire affected community's resilience.

Second, platforms influence resilience not only within the mobility ecosystem but also at an inter-industry level. Inter-industry collaboration can be seen in archetypes AT1 and AT3, as the newly created joint services also imply impacts (e.g., increased revenue) on platforms of other industries (e.g., e-commerce, delivery service, digital payment provider), non-platform businesses (e.g., local shops, restaurants), or higher-order public institutions and services (e.g., health care, government organisations). Intra-industry co-opetition between mobility ecosystem actors supports working together on pandemic-specific issues of common concern and creates value while competing elsewhere. This adds to the community resilience of the mobility platforms, as fixed costs can be significantly reduced (AT5). The centrally coordinated action to bring together different providers and services can reduce the unforeseen behaviour of single actors and facilitate the planning of adequate coping responses compared to competitors (AT4). Hence, intra-industry collaboration (as in AT4 and AT5) might provide a first step toward developing a joint ecosystem roadmap to cope with the

pandemic. In the long term, it can also enhance thus-far-unrealised potential, such as for AT4, the vision of a centralised multi-modal mobility system with an open technology stack to enable seamless cross-provider transactions. Therefore, similar to Moldovan et al. (2018), we argue that increasing the exchangeability and flexibility of ties within the broader ecosystem involving different entities for joint action and shared practices contributes to resilience at the community level.

Our findings are in line with the present literature on disasters. For example, unexpected crises might require collaboration within the ample scope of organisations and result in new inter-organisational arrangements to meet socio-economic needs (Wachtendorf et al., 2006). Similarly, resource sharing is vital for collaboration (Jiang & Ritchie, 2017), and response networks in the aftermath of unexpected disasters can also include distant actors who cover similar or complementary function domains (Lai & Hsu, 2019), which indicates that the notion of inter-industry collaboration becomes even more important in a crisis context. Interestingly, our findings also indicate that the importance of locality (Glückler & Hammer, 2011) and geographical proximity in building these new relations and collaborative services seem to play a major role. Although one could argue that platforms do not exhibit the need to select local and nearby partners for joint crisis response, as their modular architecture and matchmaking capabilities allow the integration of geographically dispersed actors, we observed a tendency toward cooperation with local partners (e.g., local restaurants, shops). Therefore, we argue that, in a pandemic context, mobility platforms might be more prone to interacting with partners who find themselves in similar surrounding conditions (e.g., regional specificity of the COVID-19 related restrictions). However, in contrast to the existing literature, we cannot necessarily confirm that there is a natural tendency for mobility platforms within emerging support networks in times of crisis to select organizationally

or cognitively proximate partners based on similar tasks or a shared organisational vision (Hossain & Kuti 2010; Comfort & Haase 2006). Our findings, on the contrary, show most new partnerships between mobility platforms and non-mobility-related actors, as in AT1 and AT3, companies that do not necessarily share a similar organisational structure.

Third, multiple public-private collaborations (AT3) serve the public good and provide a new perspective for community resilience. The existing literature on community resilience already indicates the potential impact of public-private partnerships (e.g., Chen et al., 2013). However, we found that the mobility platform partnerships add to the community resilience of both the mobility platform ecosystem (private sector) and the public-sector ecosystem. The newly formed networks facilitate joint emergency response, necessary resource sharing (Belso-Martínez et al., 2020), and the development of a mutual understanding. Especially in terms of a potential future crisis (a second or third wave), this might make it more likely to interact collaboratively with the crisis-proven partner.

Developing the Concept of Platform Ecosystem Resilience

Having outlined how digital platforms contribute to organisational and community resilience, we see the following patterns.

First, almost all archetypes (AT1, AT3, AT4, and AT5) leverage both the platform and its ecosystem, and each can contribute to both organisational and community resilience. However, the current research on resilience separately analyses resilience at the individual, organisational, and community level (Taani & Faik, 2019). We propose that digital platforms link the platform owner's organisational resilience with the community resilience of the platform ecosystem. The inherent embeddedness of digital platforms in

ecosystems and the pandemic crisis's contextual nature might explain the observed joint appearance. Thus, any resilience contribution might go beyond the organisational boundaries.

Second, all archetypes show a forward-orientation in altering their ecosystem with both short-term and long-term impacts. These impacts change the critical characteristics of platforms' business into a "new normal." For example, many platforms are addressing new user groups (DR1, DR3), shifting value propositions (DR1, DR3, DR4, DR5), changing value streams (DR1, DR2, DR3), or collaborating with new partners from the same industry (DR4) and other industries (DR1, DR3). In particular, developing a meta-platform (DR4) makes it clear that an unrealised vision, namely, a centralised multi-modal mobility system, is becoming a reality. Contrary to the origins of resilience, namely, leaping back to an old state (Sutcliffe & Vogus, 2003), resilience in the context of digital platform ecosystems means moving forward with new, innovative ecosystem behaviour.

Third, in addition to digital technologies, the platforms also took several non-digital actions. Following the past literature on resilience (Rapaccini et al., 2020), we can confirm that non-digital factors are important. However, our findings underline the dual role of resilience in platform contexts, an interplay between both the digital and non-digital side of actions. For example, Blade, an exclusive air-taxi provider, built on its platform's operational flexibility and refitted its SUVs (previously used to transport customers from the helicopter landing pad to the airport) for ground transportation to set up a new car-sharing service (DR1). This underlines the socio-technical character of resilience in the digital platform ecosystem context and stands in contrast to the existing literature on information systems which mostly neglects the social perspective of a system to support the resilience of groups.

Fourth, most of these archetypes contribute to the resilience of digital platform ecosystems in a "frugal" way. Crises force organisations to face limited access to resources in the first place and before any response action is taken. For example, mobility platforms within AT1, AT3, and AT4 required low input effort to create additional revenue in the short and long terms. Building on existing capabilities, they created a new type of service or value proposition. Also, AT2 and AT5 build on the low-effort adaptation of the existing mobility service to incentivise the demand and increase revenue from existing customers. Many actions can be developed and deployed with minimal and pre-existing resources to meet the need for timely and efficient responses to the crisis. Frugality is about creating affordable, sustainable, and straightforward services when resources are scarce (Zeschky et al., 2011; Watson et al., 2013). We see frugality as an additional concept to understand resilience in the context of digital platform ecosystems in crises. The literature mentions the efficient exploitation of resources in the context of resilience and post-disaster functioning (Hobfoll, 2002). Two examples are venture creation and the pursuit of opportunities without relying on currently controlled resources (Stevenson & Jarillo, 1990). However, the importance of mobilising existing resources (Hobfoll, 2002) and achieving resource gains (Hobfoll, 2011) in such a way that losses are replaced or substituted (Ironson et al., 1997) with minimum input effort is still under-investigated. We add to the literature on resilience regarding the mobilisation of resources (e.g., Sakurai and Kokuryo, 2014) by proposing that frugality is even more critical in crises.

The Concept of Platform Ecosystem Resilience

Our findings have shown the socio-technical character of resilience in the digital platform context as a process of "how to" achieve resilience: it is not only built on socio-technical factors but also contributes to a broader socio-technical outcome system.

Both digital and non-digital factors contributed to the resilience of both platforms and their ecosystem as socio-technical entities. As existing definitions neither cover the degree of detail nor the scope of resilience needed to account for the findings of our study and the context of platform ecosystems in times of exogenous shocks, a new definition of the concept of platform ecosystem resilience became necessary.[2] Integrating platform and ecosystem as influencing factors (*what* is used to build resilience), accounting for its a priori, frugal, transformative and forward-oriented nature (*how* resilience is being built) as well as for the long-term impact of the actions (extent of resilience *impact*) resulting in the final definition of platform ecosystem resilience as "*leveraging socio-technical factors of digital platforms and ecosystems frugally to design, deploy and use situation-specific responses to prepare for, endure and adapt by capturing new opportunities and engaging in transformative activities to cope with exogenous shocks and become resilient for future disruptions.*" This definition goes beyond the latest definition of "digital resilience" in IS (Boh et al., 2020) by highlighting how and to which impact platform ecosystems as socio-technical entities contribute to resilience on a wider level in the specific context of an exogenous shock.

Limitations

This research has several limitations, starting with the nature of case surveys. As the case survey comprises 171 cases of mobility providers and 266 relevant individual actions, we cannot explore each case in-depth. Second, the novelty of the unprecedented pandemic restricts the data sources, as it is still unfolding. New or until so far not officially announced cases might appear that need to be considered during the crisis.

[2] See Appendix B for more details on the definition development process

Furthermore, long-term outcomes such as post-crisis sales growth and mobility platform survival rates can only be revealed in a longitudinal study after the crisis. We have tried to mitigate this issue through data collection over seven months; however, only the first wave of COVID-19 has been covered. Third, to analyse the resilience-building of crisis-affected firms in-depth, we selected mobility platforms as a sample. Therefore, it is necessary for generalizability to extend the study to other platform contexts to verify the archetypes of platform ecosystem resilience. Last, and because of our study's qualitative nature, we acknowledge the somewhat interpretative stance of our theoretical construction. Although we triangulated our collected data with different sources and iterative author team discussions, we cannot exclude the notion that our findings are subject to subjective interpretation (e.g., Walsham, 1995).

Theoretical Implications

Our main contribution is the new concept of platform ecosystem resilience: resilience as frugally built by the socio-technical characteristics of both the platform and its ecosystem in a forward-oriented manner. This context-specific resilience concept contributes to two main literature streams. First, we contribute to resilience research with five archetypes that show *how* mobility platforms can leverage both the digital platforms and their ecosystems to build resilience. Specifically, we reveal that a combined and multilevel view of organisational and community resilience is needed in the context of platform ecosystems. For example, we show that the archetypes interact and positively influence different levels of analysis. Beyond the boundaries of a single organisation, resilience is also being built at an intra- and inter-ecosystem level. This contrasts with prior research on resilience, mostly focusing on organisational (e.g., Lee et al.; 2013; Vogus & Sutcliffe, 2007) and community resilience (e.g., Heeks & Ospina, 2019; Taani & Faik, 2019) in an isolated manner. Therefore, with our new concept of

platform ecosystem resilience, we are the first in IS research to acknowledge platform ecosystems as an influencing factor and the affected level of the resilience impact in times of pandemics. Furthermore, it indicates that the actions taken might lead to a long-term change in the pre-crisis status quo toward a "new normal" ecosystem behaviour, including new inter-and intra-industry partnerships. This contradicts the current understanding of resilience as a "preserve-the-past" state.

Second, our findings underline the importance of distinguishing investigations on resilience in platform ecosystems vs. non-platform ecosystems as the first indicate reinforcing effects. All archetypes show that the nature of platform ecosystems can reinforce the potential for resilience building: Platform owners as central actors can efficiently facilitate access to not connected actors of former non-platform ecosystems as they design, facilitate and alter modular architecture (e.g., AT1) and governance (e.g., AT4), this way strengthening coordination and collaboration. Coincident, platform complementors gain resilience by capitalising on joining multiple platform ecosystems with access to a variety of complementors. In return, resilient complementors reinforce platform ecosystem resilience again.

Managerial Implications

In practice, our insights provide managers a three-part understanding of how to leverage digital platform ecosystems to specifically cope with the COVID-19 pandemic, prepare for other exogenous shocks but also to develop platform ecosystem resilience generally.

First, managers can use the presented archetypes to prioritise actions, conduct fit-gap analyses, and derive roadmaps to develop platform ecosystem resilience. Using COVID-19 as an exemplary exogenous shock, we provide a structured overview of the solution space, which might be essential for identifying, selecting and planning relevant

coping actions to prepare for similar crises. This is because the identified structural changes (e.g., changed customer demands and altered consumption patterns) are introduced by (but not limited to) COVID-19 which is why platform owners can also consider the archetypes for platform ecosystem development facing similar adversities. However, we should point out that digital platforms do not need to implement all platform ecosystem resilience archetypes equally. Instead, they are asked to critically reflect and decide which are required to cope with a specific structural change.

Second, revealing different pathways of building platform ecosystem resilience might incentivise platforms to proactively turn a crisis into an opportunity. A forward-looking ecosystem behaviour might help managers use crises to further develop their ecosystem rather than leaping back to the pre-crisis status. For example, platform owners looking beyond their organisational boundaries and facilitating novel joint service innovations might generally derive stimuli for unprecedented progress of their platform ecosystem. This might generate post-pandemic advantages beyond the COVID-19 pandemic in comparison to competitors simply resuming existing operations.

Third, managers of non-platform businesses should consider and carefully evaluate either joining or building a platform ecosystems structure in times of exogenous shocks as this might benefit both their organisational and ecosystem resilience in general.

Last, policymakers should consider how they can undertake initiatives to foster the efficient structures of platform ecosystems. Specifically, long-term investments or the easing of regulations for platform ecosystems serving the public good beyond COVID-19 can support their positive societal impact on a broad scale accompanied by sustainable support of their platform ecosystem resilience.

Future Research

The initial concept of platform ecosystem resilience provides various avenues for future research. From a platform perspective, researchers should take a process perspective and conduct longitudinal investigations on how exactly platform ecosystem resilience unfolds. A time dimension helps to investigate the chain of effects from the manifested impact of the pandemic to a platform and its full recovery. An investigation into how the archetypes unfold over time, including questioning whether any specific chronological sequence or maturity level of resilience effects could be observed, might also be promising. Second, as we only included actions in the first wave of this pandemic, it remains unclear if the observed platforms are still conducting actions to counteract the effects of COVID-19 or whether they have already passed this state and are now in the "new normal." Finally, a closer look at how platforms are mobilising and switching their resources to target the crisis-related bottlenecks (e.g., dealing with the increased demand for food delivery, Uber drivers now delivering food instead of carrying passengers) could be promising, as our study takes a wider perspective on what is being done to cope with the situation.

From a platform ecosystem perspective, further studies could first examine the effects from a platform complementor standpoint, as our study mostly took the viewpoint of platform owners. For example, looking at how customers or platform workers (resilience at the individual level) cope with the pandemic and their effects on platform ecosystem resilience would improve our understanding of platform resilience. Second, as we did not shed light on different types of ecosystem, it would be interesting to investigate how the structure and type of an ecosystem (e.g., its homogeneity, complexity, innovation ecosystems, technology ecosystems) influence resilience. Third, although we found inter-ecosystem effects (e.g., impact on public service

organisations), future research could contribute by investigating how ecosystem compatibility (Riasanow et al., 2020) contributes to platform ecosystem resilience. For example, which similarities and differences (e.g., needed capabilities, resources) between two ecosystems positively influence, or even hinder, successful coping? Fourth, as our findings show positive reinforcing resilience effects that come with the nature of platform ecosystems, future research could take a closer look at potential negative effects. For example, the high level of ecosystem control centred on a platform owner could imply that complementors are hindered in their scope for resilience-coping actions or that the platform owner could have capabilities to market services that compete with complementors. Instead of positively contributing, this would mean that the platform nature could also reduce the overall ecosystem's potential to build resilience.

Conclusion

More than ever before, the current crisis has revealed the importance of individual actions for the collective strength to successfully survive the crisis. What is more, digital platforms and their ecosystems present a vast basket of opportunities to contribute to organisational and collective resilience. Our study addresses the research question on how digital platforms and their ecosystems may be leveraged to develop resilience. To do so, we followed the case survey approach to identify relevant coping actions to develop resilience by building on digital platforms and their ecosystems. This is manifested through our five archetypes and their key context-specific factors. As the archetypes interact and imply consequences for various actors, we also contribute by showing that socio-technical factors can positively influence the resilience of single platforms and the entire ecosystem. Moreover, our findings indicate a "new normal", transformative, and frugal notion of resilience, a state where changed practices define

the new reality instead of pre-crisis established positions of being, which can be reinstated once the situation returns to normality. In this way, the archetypes operationalise and extend existing knowledge on organisational and community resilience by deriving a first understanding of platform ecosystem resilience. In sum, our findings help practitioners by providing a structured overview of potential short-term coping actions for crisis times, with many having the long-term impact of generating post-COVID-19 advantages.

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