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Institutional pioneers and articulation work in digital platform infrastructure-building of mobile payment vendors

Digital platforms are an important organising form in business-to-business markets and have mirrored increasing research in end-user customers' interactions with digital platforms. Much less studied are the digital platform infrastructures underpinning this customer interfacing activity which must be built and maintained for digital platforms to exist and operate. We explore how institutional pioneers attempted to build a new digital platform with a vision of the cashless society beyond the traditional payment methods. Our findings demonstrate the insightful role of institutional pioneers in digital infrastructure-building through energizing the direction, network goals, positioning with other market-actors in the backstage. We show how the tensions produced by the organizing and ordering activities in the digital infrastructure field are resolved through brokering, alignment and workarounds. We unravel the way institutional pioneers use articulation work to define a legitimate course of actions for all actors in their organizing of standards, structure and behavioural focus.

Keywords: digital platforms, articulation work, infrastructure-building, institutional theory, tension, mobile payments, cashless society

1. Introduction

Digital platforms (e.g. Alibaba, Salesforce, Amazon Web Services) have emerged as an important organising form in many aspects of markets and society between industrial actors (Gawer and Phillips, 2013; Orlikowski, 2007; Orlikowski and Scott, 2008; Sklyar et al., 2019). A digital platform is defined as “a building block, providing an essential function to a technological system – which acts as foundation upon which other firms can develop complementary products, technologies or services” (Gawer, 2009: 2). The literature on digital platforms mainly focuses on customer experiences and communications (Costello and Reczek, 2020), business models (Täuscher and Laudien, 2018), advertisers and policy makers (de Reuver, Sørensen, and Basole, 2018), algorithm use and product or service (Kohtamäki et al., 2019). Digital platforms are mainly evaluated in terms of the organisation of front-facing capacities. While important, these studies only reveal one side of digital platform activity and reflect mostly the accomplished journey. Yet, vision alignment is a long and fragmented process that is affected by the influences of multiple

actors in the construction of a new socio-technical order (Ciborra, 2000). Studies in multiple disciplines have offered a similar analysis, including research in the fields of social informatics (SI) and science and technology studies (STS) (Kling and Scacchi 1982; Star and Bowker 2006), along with information systems (IS) (Tilson, Lyytinen and Sørensen, 2010).

One relatively neglected area of investigation, however, is the digital infrastructures that support the front-facing digital platforms. Digital infrastructures are normally taken-for-granted but they must nonetheless be built, maintained and made to work for digital platforms to exist and develop (Tilson, Lyytinen and Sørensen, 2010). Digital infrastructures are defined as “shared, unbounded, heterogeneous, open, and evolving sociotechnical systems comprising an installed base of diverse information technology capabilities and their users, operations, and design communities” (Hanseth and Lyytinen 2010). Susan Leigh Star and related studies (Star and Ruhleder, 1996) emphasized one of the characteristics of infrastructure is that it “...becomes infrastructure in relation to organised practices” (1996, p.112) and relies on organising practices. Digital infrastructure-building therefore relies on some form of organised activity by a group of actors in order to be considered an infrastructure. We contend that it is critical to examine how various actors organize the activities that lead to the building of infrastructures behind digital platforms. Given that digital platforms have emerged from digital infrastructures, it is likely that the ways digital platforms operate are deeply influenced by the sociotechnical systems that govern digital infrastructures. Therefore, by unravelling the institutional dynamics between the actors of the sociotechnical systems in digital infrastructures, we also advance the understanding of how digital platforms come to emerge, operate and evolve.

In this study, we focus on the limited literature that recognises not only the role of large organisations but also of small or medium digital enterprises (i.e. background market actors) in

influencing digital platform infrastructure-building. Specifically, we advance the argument that digital platform infrastructure-building requires a set of organising institutions which create spaces for social interaction (Geertz, 1978; Logue and Grimes, 2019; North, 1990). The institutions also link different actors, provide governance (i.e. rules of the game), regulation, and establish legitimate ways and courses of action. Adopting an institutional theoretical perspective (DiMaggio and Powell, 1983; Hinings, Gegenhuberb and Greenwood, 2018), we aim to understand the particular actions and ways of digital platform infrastructure-building organizing (Hinings, Gegenhuberb and Greenwood, 2018) and the building of institutional architectures that configure socio-political contexts (Fligstein, 2001). At the heart of institutional theory is that organisations tend to become similar because they conform to the same legitimacy and socio-cultural pressures (Aksom and Tymchenko, 2020; Meyer and Rowan, 1977).

In digital platform infrastructure-building, the challenge is that there are numerous business types, sizes and industrial sectors, business models involved, each with different ideas in relation to the basis of work, provisions, standards, meaning, norms, over frameworks of success and underlying assumptions (Orlikowski and Barley, 2001). Reflecting this, studies show that digital platform infrastructure-building is often a long, difficult and fragmented process whereby multiple actors seek to; (i) accommodate different, sometimes competing or contradictory, visions and interests and goals (Karasti 2014), (ii) influence each other to constitute a new socio-technical platform order (Ciborra, 2000; Raynard, 2016), (iii) elicit value appropriation and control (Garud, Jain, & Kumaraswamy, 2002), (iv) institute ways of doing things (Hinings, Gegenhuberb and Greenwood, 2018), and (v) generate microstructures and institutional architectures (Fligstein, 2001). Studies also show that such heterogeneous settings have a high tendency for tension (Jones et al., 1998). Here, tension is defined as the opposing intentions of individual, organizational or

interorganizational forces (Zeitz, 1980), and this can cause rivalry actions among organizations towards each other (Chen et al., 2007). Critical in digital platform infrastructure-building, therefore, is the process of identifying, orchestrating and exploiting the shared logic and structure. In order to achieve this, we advance the argument that articulation work, which refers to “the specifics of putting together tasks, task sequences, task clusters - even aligning larger units such as lines of work and subprojects - in the service of workflow” (Strauss, 1988), is needed to sooth and resolve tensions, to search for a compromises and define a legitimate course of actions for all actors in their organizing infrastructure-buildings activities. Therefore, how can infrastructure-building actors purposefully build existing institutional arrangements in order to support digital platform infrastructure, while also accommodating different, sometimes competing or contradictory, digital platform pressures and goals (DiMaggio and Powell, 1983)?

This question is germane to the analytical challenge of our paper aim, which is to identify how organizations actively work on influencing the organisation of socio-cultural prescriptions in digital platform infrastructure-building activities. In particular, it first explores the role of institutional pioneers, the early institutional actors who shape the boundaries of an organizational field (Farjoun, 2002), in establishing the digital platform rules of engagement. Second, it explores how backstage market actors, those with a support role, work with and navigate the emerging digital platform rules of engagement to accomplish digital platform infrastructure-building. Our focus on what market actors do in digital platform infrastructure-building has up-to-date received little consideration in the literature (Tilson, Lyytinen and Sørensen’s, 2010), apart from the more technical role such as ‘code forking’ in digital infrastructure (Andersen and Bogusz, 2017). Taking these two objectives together, our study differs markedly from the front-end and forward-facing studies on platform-creation and maintenance approaches which characterize debates more

generally (Lessig 2001; Zittrain 2008; Ebru and Sema, 2014; Marwirck, 2015). This study therefore responds to these limitations and to Tilson, Lyytinen and Sørensen's (2010) call to generate a more research on sociotechnical aspects of digital platform infrastructure-building, by exploring not only issues of change and control but also theorising how digital infrastructures emerge. The aim and objectives are addressed by exploring digital infrastructure-building in the mobile payments industry (Storbacka and Nenonen, 2011).

The findings provide insights into the role of institutional pioneers in digital infrastructure-building in terms of energizing the direction, network goals, positioning and identity with other platform-actors who work in the backstage. The findings, moreover, show how the tensions produced by the organizing and ordering activities in the digital infrastructure field are resolved through brokering, alignment and workarounds. Our study makes three theoretical and practice contributions to the literature. First, previous research has focused predominantly on front-facing evaluations of digital platforms. In contrast, we suggest that digital platforms do not operate alone but are supported by digital infrastructures which comprises institutional pioneers and other market-making actors who operate in backstage. As such, it is also essential to study the institutional actors who work in digital infrastructures. Second, we emphasize two important insights that have been lost from view in many of the platform studies, namely, that institutional pioneers are important providers of formalizing the rules of engagement in digital platform infrastructure-building and that organizing and ordering activity often produces *both* positive and negative tensions. These tensions have not been examined in the literature but are important as they must be resolved if the actors want to move the digital infrastructure field forward. We identify three key formalization of the rules of engagement that help solve the tensions. Third, we focus on the specific role of institutional pioneers in soothing the tensions with articulation work

in their task of managing and stabilizing exchanges between infrastructure-building actors. We find that digital platform infrastructure-building is a hierarchical one, in which influence primarily flows outwards from important institutional pioneers. This underlines the contested nature of digital platform infrastructure-building and highlights the important role of articulation work in the soothing over such tensions. This finding contrasts sharply with work that is characterized by conflict or overt “antagonisms to the organisational arrangements required by [traditional] institutional referents” (Pache and Santos, 2010, p. 457). Finally, we show the issues at play in digital platform infrastructure –building. Particularly, we unravel the links between the different actors and how governance and regulation dictate legitimate courses of action. Past research on institutional voids shows that weak or absent institutions inhibit the establishment of Western-style markets. However, our study shows that weak and lacking formal institutions can force institutional pioneers to rely more on articulation work to develop workaround issues, as previously suggested by the work of Dupret’s (2010; 2017).

We start by reviewing the platforms and infrastructure studies, before discussing the idea of articulation work, before explaining our methodology. Data from three collection procedures consist of (i) thirty in-depth interviews in two countries, (ii) forty-six online data sources, and (iii) observations at three field business conference sites are then analysed. Next, we discuss the findings and outline the implications for academics and practitioners.

2. Literature review

The role of institutional pioneer influence in digital platform-building and in particular the link with articulation work remains relatively unexplored despite a potentially promising connection. In this section, we begin by discussing the growing literature on digital platforms and

infrastructure-building in some detail, and then connect these streams of literature with the concept of articulation work and present the research question that motivated this study.

2.1 Institutional pioneer influence in digital platform infrastructure-building

The term ‘platform’ has been employed in a variety of ways, sometimes as a form of marketing pitch, sometimes as technical ‘platforms’, sometimes as ‘platforms’ from which to speak, sometimes a signal for critical mass appeal and opportunity (Gillespie, 2010). Theorizing of digital platforms has been undertaken by a range of academic fields, including economists (network effects, information asymmetry, two-sided markets, patterns of technological change) (Arthur 2009), legal scholars (forms of information creation and distribution, intellectual property and control) (Lessig 2001; Zittrain 2008) as well as management and consumer marketing academics (Ebru and Sema, 2014; Lee and Watkins, 2016). In particular, there has been a considerable amount of research on social media platforms such as Instagram, Twitter, Facebook, Weibo and Youtube, particularly on issues relating to user engagement, satisfaction, control and privacy (Cenamo and Santalo, 2019; Kuang et al., 2019; Marwirck, 2015). From marketing academic research, the presence of influencers (e.g. Instafamous on Instagram and vlogger on Youtube) in the building and functioning of social media communities has been an important area of study (Chua and Chang, 2016; Chao, 2017; Cocker et al., 2021; DeVairman, Cauberghe and Hudders, 2017).

Equally significant, but much less discussed, is the influence of sociotechnical institutional arrangements in the building and functioning of infrastructure (Star and Ruhleder, 1996). Existing studies show that infrastructure relies on some form of organised activity by a group of actors: “Analytically, infrastructure appears only as a relational property, not as a thing stripped of use” (Star and Ruhleder 1996, p. 113). While the term “infrastructure” is used to refer to the physical

support systems of hardware, wires, applications, pipes, networks, pathways, research nonetheless shows that it is intertwined with social dimensions such as language, practices and community (Star and Ruhleder, 1996; Kling, 2000; Star and Bowker, 2002). Karasti (2014) describes infrastructures as interrelated technical, social, and organizational arrangements involving hardware and software technologies, standards, procedures, and practices. As a broad functional category, though, it also includes an array of services and support (Star and Ruhleder, 1996; Star and Bowker, 2002). These are reflected in Hanseth and Lyytinen's (2010) definition of digital infrastructures: "shared, unbounded, heterogeneous, open, and evolving sociotechnical systems comprising an installed base of diverse information technology capabilities and their user, operations, and design communities" (Hanseth and Lyytinen, 2010).

The research fields of social informatics (SI) and science and technology studies (STS) (Kling and Scacchi 1982; Star and Bowker 2006) have contributed significant insights into the way that infrastructure is conceptualised as "a relation not a set of things" (Sandvig, 2013: 10). An interesting focus for both fields of research lies in the ways through which digital infrastructures come about. One stream of research places a strong emphasis on strategic-relational role of wholly controlled by single organisations, for example, Apple or Samsung, in leading and driving construction of digital infrastructures (Ciborra 2000; Eaton et al. 2015). Here, studies show how organisational structures (Henfridsson and Bygstad 2013) and boundary objects (Eaton et al. 2015) determine infrastructure development. Another research stream centres on the generative capacity of digital infrastructures to transform organisations (Hanseth and Aanestad 2003). Andersen and Bogusz (2017) explore the practice of 'forking of the underlying source code' as a pivoting moment of self-organising in new digital infrastructures supporting open source projects in the blockchain communities. This study shows the role of self-organising in distributed communities emerging

around digital infrastructures that can emerge independently or in the periphery of a field. We therefore understand digital platform infrastructure-building as linking different actors between diverse and distributed communities across industrial sectors, whilst also providing governance and regulation and establishing legitimate courses of action (Hinings, Gegenhuberb and Greenwood, 2018). For example, the large-scale collaborative digital platform efforts required for the contactless payment between financial institutions such as banks, software, hardware companies, transportation companies, GSM (Global System for Mobile Communications) operators, intermediary project managers (TSMs) and payment associations. To date, and despite their shared concerns with digital infrastructure priorities, these two approaches have been developed in mutual exclusion, ignoring that digital infrastructures and organisation can coevolve (Tilson et al. 2010).

The digital infrastructure-building challenge, as Ciborra (2000) notes, is that “vision alignment is a long, tortuous and fragmented process whereby multiple actors and resources try to influence each other to constitute a new socio-technical order.” Nowhere is this dynamism and coevolution more apparent than in the tensions and conflicts. A significant challenge of infrastructure-building is in instituting a governance system for reproducing social order, and questions of value appropriation and control (Botzem and Dobusch, 2012; Djelic and Sahlin-Andersson, 2006; Garud, Jain, and Kumaraswamy, 2002; Raynard, 2016). Pioneers of digital infrastructure platforms seek to infuse their norms, values, or institutional ways of doing things, into the infrastructure (Hinings, Gegenhuberb and Greenwood, 2018). This requires institutional pioneers to influence both formal and informal norms to generate market microstructures and institutional architectures that configure socio-political contexts (Fligstein, 2001). Recent work in the economic sociology of markets (Fligstein, 2001; Zelizer, 2005) argue that these practices cannot happen in isolation as

they require a set of organising institutions, which create spaces for social interaction as well as complex bundles of institutions (Geertz, 1978; North, 1990).

The analytical challenge, then, is to identify those institutional practices that influences infrastructure-building. While a single dominant firm may open the way into new markets, most often, new markets entail a collective pursuit, wherein firms collectively form, coordinate and enhance innovation value. It requires, moreover, structured interaction by institutional pioneers to create mechanisms for such coordination, which may, in turn, have knock-on effects for digital infrastructure-building. Institutional pioneers influence infrastructure-building practice. First, from an institutional pioneer perspective, there must be early actors who actively contribute to shaping the boundaries of the digital infrastructure field by defining the rules of engagement so that following actors can refer to the rules in order to position their role and expand the field (Farjoun, 2002). Second, the dependency with social and technical components identified as mutually interdependent. Sociological institutional scholars refer to this mechanism as ‘coercive isomorphism’, defined as ‘both formal and informal pressures exerted on organizations by other organizations upon which they are dependent’ (DiMaggio and Powell, 1983: 150). The platform infrastructure providers can therefore apply pressure through both financial incentives and institutional engagement. Financial incentives can be both positive — the strengthening of the digital platform can result from a desire for more investment funding — and negative — institutional change is the result of a desire to avoid existing resources being withdrawn. Digital platform can tie provision of support directly to particular types of technological which can powerfully affect institution-building processes.

Third, another important way that institutional pioneers influence infrastructure-building is through ‘socialization’, which can be defined as a ‘process of interaction that involves changing

attitudes about cause and effect in the absence of overt coercion’ (Checkel, 2001: 562). Such interaction might help problematize the institutional status quo in the digital platform infrastructure-building — as well as frame the way in which the problem is understood, and what potential solutions to it might look like. Similarly, socialization research shows that the intensity and duration of contact crucially shapes the extent of adoption of new ideas about cause and effect (Bearce and Bondanella, 2007; Checkel, 2005).

Fourth, another aspect of infrastructure –building captures the idea that institutional pioneer influence stems from the success and attractiveness of its institutional designs. The institutional pioneer acts as a Red Queen in which others learn from the effects generated by the institutional choices of others, particularly those that pioneer them. As institutions start to take effect, they allow other platform vendors to gauge whether they are successful in generating the desired outcomes. Familiarity and success are thus key conditions for learning.

A final institutional way in which institutional pioneers might affect digital platform infrastructure-building is through emulation. Emulation is defined as a process whereby ‘actors model their behaviour on the examples provided by others’ (Lee and Strang, 2006: 889). As organizational fields become structured through associational processes, they develop standards for the legitimate institutional forms that organizations gradually adopt in an attempt to enhance their legitimacy — and ultimately their chances of long-term survival (Patala et al., 2019; DiMaggio and Powell, 1983). Institutional pioneers are particularly likely to be emulated given the premium that exists in organizational fields for appearing similar in structural form to the most admired and successful organizations (Haveman, 1993).

This research highlights how ‘rules of the game’ in platforms points to the relevance of the context and processes by which they emerge (Fligstein, 2001; North, 1990). The process of

institutionalizing the rules that govern exchange and market-based activity is ongoing and observable, and as such provides a lens for observing market building and the activities of diverse institutional actors (Santos and Eisenhardt, 2009; Stark, 1996). The argument is developed that if institutions are absent or weak, institutional voids occur and a compensatory social structure is needed (Khanna and Palepu, 1997; Greif 2006). These institutional pioneers are seen in a foreground and primary type of infrastructure-building work, whereas much less acknowledged would be supportive nature of work, which is now discussed as articulation work.

2.2 Articulation work in digital platform infrastructure-building

The concepts of “articulation work” and ‘articulation processes’ were introduced by Anselm Strauss (1988, 1993) to understand the work within projects or, how a project’s participants get their work done. This early work perspective has been theoretically advanced in relation to a range of conceptualisations including, boundary-work (Gieryn, 1983), work as talk (Gronn, 1983) and translation work (Latour, 1992). More lately, the nature of work has become important in institutional studies, with Lawrence and Suddaby (2006) and other studies presenting interesting findings in relation to the political, technical and cultural work of institutionalizing management fashions (Perkmann and Spicer, 2008) and the practices of ‘boundary-spanning’ in renegotiating forestry practices (Zietsma and Lawrence, 2010). Although the work perspective is not exclusively concerned with institutions per se, this research helps with theoretically framing the nature of articulation work from institutional pioneers in platform infrastructure-building that it brings together the interrelating parts or the alignment of different work elements and actors, comprising a range of planning, coordinating and negotiating work that gets done. Articulation work is one constituent part of an overall articulation process. In terms of platform infrastructure-building, this would refer to “the specifics of putting together tasks, task sequences, task clusters - even aligning

larger units such as lines of work and subprojects - in the service of workflow” (Strauss, 1988). Simone et al (1995) focus on articulation as “the orderly accomplishment of cooperative work” with some of the most interesting research in this area concerned with understanding how articulation work accommodates; it is malleable or open to modification and has linkable coordination mechanisms (Schmidt and Simon, 1996; Fjuk and Smordal, 1997; Simone et al, 1999). Fujimura (1987) suggests that “articulation is the work of pulling together everything that is needed to carry out tasks: planning, organizing, monitoring, evaluating, adjusting, coordinating and integrating activities. Some of the most interesting research in this area presents articulation work as a socio-technical concept which recognises the social practice of adjusting regular work patterns to accommodate contingencies; augmenting or taking on additional work in order to facilitate the arrangement, and working around or the use of alternative, even non-approved methods to facilitate work. Gerson and Star (1986) emphasize the making of visible activities that are not conceived as work but that still require skill and knowledge to perform, for instance, managing for, dealing with, and overcoming tension (Fernandez et al., 2014). Articulation process represents a more inclusive way in understanding the range of tensions; it refers to “the overall process of putting all the work elements together and keeping them together.” This articulation evolves around: (i) generation of ideas and reactions, (ii) interactional processes and continual alignment (including negotiating, persuading, educating, manipulating) and (iii) types of work.

The generative idea and reactions. Strauss (1988: 165) refers to the way that an institutional pioneer must begin with a vision – an image, an idea, a notion – of what can, might, or should be done. Because the vision does not yet constitute reality, or even necessarily a sense of how to make the vision into reality, the initiator (whether more like a dreamer or a planner) must consider ways and means of implementing the vision; otherwise disruptive problems will haunt the entire

infrastructure-building project. In considering articulation work and articulation processes as an inherent part of infrastructure-building, institutional tensions can arise whenever firms engage within and across a diverse array of industries, communities, institutions, studies show that this encourages competitors to straddle multiple social domains whose actors impose different and often incompatible rules, expectations, timing and templates.

Interactional processes and alignment. Strauss (1988:166) considers the additional interactional processes that are central to the articulation process. These include persuading others, teaching relevant others about the value or feasibility of the project, or negotiating some exchange that will make the project seem worthwhile to them. He argues that at least two other interactional processes may be involved including, manipulation (such as not revealing everything about the goal or plan) and coercion or the threat of coercion. These interactional processes can produce institutional tensions, particularly where possible impediments to the workflow arise from new disturbances or disruptive elements to these. Critical in that respect is accomplishing the alignment of workers, that is, the process by which workers fit together their respective work (Corbin and Strauss 1988).

Types of work. Strauss (1988:167) also suggests that the articulation process begins with envisioning (or are forced to envision) the work itself, the component tasks, and who will do what tasks in what division. Strauss (1988:166) identifies three essential processes, including, (i) insuring the flow of resources, (ii) making arrangements about the division of labour, (iii) matching workers' motivations with tasks, and (iv) supervising delegated or assigned responsibilities for tasks. Delegated, assigned or agreed-upon responsibilities almost always permit some degree of discretion and that can produce tensions around accountability for task accomplishment. To deal with potential tensions, particularly around getting things done, that articulation work is a way to address the “clash of ideas or principles or actions and the discomfort that may arise as a result.”

(Stohl and Cheney (2001, pp. 353–354). Star (1991) stresses the importance of understanding the work performed around formal practices since individuals may work around technologies (Ash *et al.*, 2004; Dupret, 2017), or take some of their work ‘underground’ (Abetti, 1997; Augsdörfer, 1996; Knight, 1967). In the next section, further details on the digital platform infrastructure-building undertaken in the mobile payment industry is outlined and a concise account of the methodology are provided.

3. METHODOLOGY

An exploratory study of the platform infrastructure-building in the mobile payments industry was undertaken. This study followed Yin’s (1994) guidelines for ‘purposeful sampling’ in choosing an industrial sector. Since its origin in the early 2000s, the mobile payments industry has witnessed exponential growth both in the scale and scope of the importance of cooptation strategy (M’Chirgui, 2009; Ozcan and Eisenhardt, 2009). Typically, mobile payments are distinguished from non-mobile payments (conventional credit, debit or ATM cards) through a radio frequency communication protocol, which is activated when the card is in the proximity of a transmitter. As outlined, this new market penetrates various markets including supermarkets, vending machines, public transportation, payroll remittance, parking, restaurants, and petrol stations, with different institutional actors involved such as financial organisations, mobile phone manufacturers, software, hardware and Information Communication Technologies companies. Within this global industry, thirty platform firms, defined by the European Payments Council (2010) as actors in the mobile payments industry, were included in the UK and Turkey as representing the two countries leading the field for mobile payments (Card Technology Today, 2007; Sanders, 2008). Unlike previous studies that use dyadic relations, multi-party relationships that embrace both large institutional pioneers and small medium sized firms (SMEs) were chosen

to investigate the articulation work in digital platform infrastructure-building. Given the nascent stage of the mobile payments industry, supplementary data via purposeful and snowballing sampling online and by attending three business conferences, as recommended in the research of Katz and Gartner, (1988), Garud (2008) and Santos and Eisenhardt (2009) were also used. Our overall approach to data collection and analysis was premised on the institutional work (Lawrence and Suddaby (2006) and practice perspectives (Feldman and Orlikowski 2011) and accordingly examined attitudes toward digital infrastructure-building pioneering and articulation work, and associated commitments as strategic, social and relational and social and enacted in concrete situations. This examination was enhanced by drawing Rowbottom and Bueno's (2011a, b) concept of epistemic stance which engages with, and describe how, actors are pursuing and evaluating new technical systems and knowledge. Consistent with the institutional and practice perspectives, the concept of epistemic stance conceives attitudes toward knowledge, which reflect beliefs about the world and the pursuit of knowledge (see also Fayard et al. 2016).

3.1 Data Collection

We used a qualitative approach to collect and analyse the data (Leitch et al., 2010). Data triangulation was adopted via (i) field observations at three business conferences, (ii) thirty in-depth interviews in two countries, and (iii) online data sources. This facilitated unpacking the respondents' interpretations, definitions and associated infrastructure-building issues -tensions- through social interaction (Yin, 1994, Healy and Perry, 2000). The data collection was conducted 2000 to 2012 because that had been the main period when the digital platform infrastructure-building had taken place and this predated the Covid-19 global pandemic, which arguably catalysed further the contactless mobile market and brought much more consumer-side visibility to that digital platform. The study draws upon Healy and Perry's (2000) six criteria are used as the

benchmark to judge the quality of this research including, ontological appropriateness, contingent validity, multiple perceptions, methodological trustworthiness, analytic generalisation and construct validity. The study relied primarily on three data collection techniques:

Business Conference Fieldwork Observations. At conferences, organisations interact and share experiences, declare agendas and offer opportunities for further cooperation arrangements (Garud, 2008; Anand and Jones, 2008). To illustrate the diversity of platform infrastructure-building interactions, Table 1 shows the geographical origins and positions of attendees in one of the three mobile payment industry conferences, while Table 2 expands on the characteristics of the firms. An ‘etic’ or outsider view, which suggests being present in a non-participatory way at three industry conferences, was applied. ‘Peer debriefing’ which entails the field researcher engaging the other authors not involved in the fieldwork to discuss emerging patterns in the data was used. The first field observations were elicited from an annual one-day business conference in Manchester, followed by a three-day business conference in Brussels and a three-day conference in Paris. A moderate participation, as advocated by DeWalt and DeWalt (2010), sampling was used as this decreases the risk of researcher’s manipulation and bias. The observations included the content (e.g. discourse and material-slides, and papers) of the presentations, panels, and discussions as well as the participants’ attitudes. The aim was to observe the participants and their relations with each other, presentations and their behaviours while they were engaging with other members both during the sessions and social breaks.

INSERT TABLE 1 & 2 ABOUT HERE

Interviews. Thirty in-depth interviews were conducted in countries - Turkey (18) and the UK (12) - that host leading firms in the mobile payments industry¹. Interviewing began with convenience sampling.. An interviewing method, which started with unstructured interviews that are followed by semi-structured interviews, as more insights evolve, was adopted. First, eight pilot interviews with industry experts were conducted. These eight interviews together with the literature review were used to develop the first set of questions that were designed as unstructured and open-ended questions. The questions asked during the interviews included for example: Tell us about your experiences and the issues originating from a multi-party environment and how do you manage them? Tell us about your positive or negative outcome experiences? How do these issues affect the accomplishment of cooperative practices?

Themes investigated in the interviews were two-fold: institutional pioneers and articulation work. Within the institutional pioneer theme these included understanding: (i) the pioneer ‘rules of engagement, (ii) visions and futures, and (iii) the dynamics of boundaries, models and standards. Within the institutional pioneer theme these included understanding: (i) brokering work tasks and processes, (ii) interactional alignment, and (iii) retrofitting, backfilling and backstops. At this stage, using terms “institutional pioneer” and “articulation work” to allow a natural narrative was deliberately avoided. To maintain consistency, one author conducted and transcribed all the interviews both in Turkish and in English.

Online Data Sources. The selection process for online data was “search engine” (Google), purposeful sampling (Weare and Lin, 2000) Keywords used for the search included “mobile payments”, “contactless payments”, “NFC” and “tension”. Searching ceased when information repeated on multiple websites and no further new items emerged. As the virtual databases attract

¹ The list of interviewees and the details of online resources are available up on request.

participants from all around the world, material with a global perspective resulted. This provided a broader coverage of the tensions applicable to market creation activities. Overall, the search criteria returned 46 useful data sources. The data collection sources are attributed to the findings with prefixes (for example, I24- refers to interviewee 24, while W refers to weblog, and M is Mission statement).

3.2 Data Analysis

To capture the social-spatial nature of infrastructure-building an interpretivist analysis was chosen (Leitch et al., 2010; Spiggle, 1994). This allows (re)cycling between theory and the field data. Because the data was collected by different methods (interviews, event observations, online and secondary data sources) we used NVivo9, a computer aided tool to analyse qualitative data, to assist with our analysis (Crowley et al., 2002). A thematic analysis technique was employed, and all emerging themes were developed in a structured coding process (Boyatzis, 1998). First, the transcripts were read which allowed familiarisation with the data: searching for ideas, patterns, common ground and opposition within the respondents' language and explanations. NVivo9 was used to create a series of categories and sub-themes. This inductive process (discussed among authors) identified the collective cultural register. These first order themes were then shifted between the data and the literature (Santos and Eisenhardt, 2009). This process developed the second order themes – axial coding (Corbin and Strauss, 1990). At this stage, to uncover the frank meanings beneath the expressions, a semiotics approach was applied (Gudwin, 2005). This process produced a number of themes on (i) the role of the institutional pioneers and other infrastructure-building actors, (ii) the tensions around digital platform infrastructure-building and (iii), and the articulation nature work. The approach fully situated digital platform infrastructure-building tensions in the everyday life of real individuals, thus making sense of a very complex, highly

personal activities and experiences. A summary of the five stages of our data analysis and coding process can be seen in Table 3.

INSERT TABLE 3 ABOUT HERE

Our research approach concentrated on tension types that primarily required an individual to deal with digital platform infrastructure-building and therefore we chose not to focus on other issues, such as the cultural difference between the UK and Turkey. To increase the validity and reliability of the study, the themes were discussed with other academic researchers, who were not involved in the project, which allowed justification and open questioning of the coding. We then proceeded with discussing the findings with industry experts. The next section presents the findings detailing the tensions in articulation work in digital platform infrastructure-building.

4. FINDINGS

The findings comprise two sections. The first outlines the role of the institutional pioneers in influencing the digital platform infrastructure-building. The second then outlines the dimensions of the articulation of work. Table 4 provides a summary of main thematic findings from our analysis of the institutional pioneers and articulation work in digital platform infrastructure-building

INSERT TABLE 4 ABOUT HERE

4.1 Institutional pioneers' influence

Energizing new directions for building. Institutional pioneers sought to fill voids in the institutional provision and to assert a new future through organisation. Institutional pioneering work therefore raise a series of questions for how things are currently done, why that is restraining and stifling provision and what needs to be done in terms of digital infrastructure-building. Infrastructure-building initially comprised energizing new directions and determining the momentum:

I24: "...banks always avoid risk taking, proceed very slowly (iii) with overconfident steps. However, on the other hand the mobile world is completely the opposite... Faster progress is in place through immediate launching, immediate starting of the eee. .. product cycle. The harmony of these two parties is crucial. In fact, here the more eeeee... the most difficult part is this. From our perspective, banks are too slow (iii) everything proceeds through procedures."

This activity focuses attention on the key decisions – what is involved and what needs to be done in order to accomplish, as explained in the following excerpt:

I24: "We are designing and preparing the "dream infrastructure" for the ecosystem. Then, our aim is to make the ecosystem to start working on the business system. We are creating the sample models for the rest of the ecosystem to encourage them. They might not like our leadership (we hear such things), but this way the right models will emerge."

Discovery of digital platform network goals. Another significant sub-theme suggested by the data analysis is the elicitation of visions and settling of network goals in organising. The institutional pioneers sought to not only serve their "own goals" but also elicit and settle network goals in the digital infrastructure-building. Institutional pioneers force parties to articulate their individual visions and discover mutual goals explicitly during the infrastructure-building.

W17: "There are many who will make light of the recent company set up by AT&T, Verizon Wireless and T-Mobile USA, with partners Barclays and Discover Financial Services, to create a "contactless payment" solution (iv)... "This grouping is not likely to last long, nor will it make much of an impact while the companies stick it out," says E. S., publisher of <http://www.SSS.com>. There are many obvious hurdles. Each participant in the new ecosystem will try to garner as much... and that always means disagreement..."

On an individual level, such discovery processes are associated with synthesizing issues on paper, eliciting opinions, perspectives, reflections and getting vendors to think deeper. In this practice, institutional pioneers seek to deliberate on and carefully express the rules and procedures and how that might look in the future:

Converging competing agendas. The experiences of the mobile payment vendors show the importance of convergent work in organising. One vendor's individual mission stated that they wanted to "lead the competition", and "shape the market" which brings reactions from the other digital vendors. As the following quotations indicate, there is an ambition to be the pioneer and control that infrastructure-building through those claims:

M02: “We lead the competition and shape the market through fresh, original solutions. Innovative”... As the opinion and practice leader of the sector, we set the agenda for mobile telecommunications in... Our strength stems from our diversity, creativity and innovation.”

W11: “Banks remained concerned that SKT's control over the Moneta Chip would allow SKT to control what services were proposed to their customers.”

In organising infrastructure-building directions with missions, some digital platform partners sought to impose “their own models” as the industry standards and use several strategic techniques to convince other partners. For example, when a partner announces a strategic mission as “put an end to banknotes and small change” by 2023 (I15 Interview), they would perform several strategic manoeuvres to achieve their goal, such as persuasion and leading the collaboration. These activities cause strategic tension as the Contactless Products Manager in one of the organisations stated:

I28: “At that time, actually, GB started with an online application and dominated the market. Eee... consumed an innovative technology too early (iv), indeed. Eee... like eee... but when observed the bank waited for 17-18sec., some customers, because authorization at some dial-up terminals lasted 17-18sec.”

The institutional pioneers engaged in territorial jostling, particularly across horizontal competitors. This is generally because partners’ dependencies and domination determine the direction of the conflict. The quotation from I15 interview is interesting because it demonstrates these points. The territorial conflict is reflected to the next excerpt through their independence seeking behaviour;

W40: “MasterCard likely will endorse a joint venture to be launched by handset maker Nokia and Germany-based card vendor Giesecke & Devrient late this year to download and manage applications on NFC phones. The companies say the service will be independent of operators (ii), handset makers, SIM vendors and banks.”

The respondent is worried about the “partner stepping into their territory” and “showing an objection” to the other partner. The awareness is conscious as the respondent is aware of threats and ready to defend his territory. The focus of conflict is upstream because in this specific case the other party is an international regulatory organisation and the respondent’s organisation is, in effect, subject to their rules.

W40: “Banks don’t like the idea of allowing operators to control the master key (iv), even if the latter have no access to the area on the chip that holds the payment application. “If the operator controls the master key, then the operator controls the environment.”

4.2 Theorising roles and models

Another important subtheme related to the way at institutional pioneers sought to abstract their own way into a generalizable model of infrastructure-building in order to remain consistent in their approach to the market. This mostly comprised role positioning and business model configuring.

Role positioning identity. In organising, the institutional pioneer formalises the articulation of the digital infrastructure-building roles, models and standards. There were three subtle, yet complex ways, that role identity was undertaken: jostling, expulsion and second protection of autonomy. In terms of roles, there was a degree of ‘jostling’ which is usually accomplished with questions over who is included and excluded, disagreements and opinions on a number of critical points bringing out contrasting competitive positions. A different illustration of this role positioning identity can be seen from the below excerpts obtained from an online data source:

W44: “They've taken all the interesting bits and remodeled [sic] them around their own "Bigpond" content offer. There's no doubt nothing illegal about that - it just leaves D.C.M. out in the cold (i) as to their future royalty payments”

I24: “...at the end of the day, this is a complex ecosystem (i), the application in the NFC ecosystem. There are main players, operators, mobile operator and the bank, but at the back the SIM card needs to be NFC compliant... Of course, their application is utilized through their permission.”

In this quotation, the tension is created by exclusion by leaving D.C.M. “out in the cold”. When the partners wanted to promote the product, the more conservative partner “refuses to be referred” in the same promotional material with the less conservative partner. The findings show that the digital infrastructure-building is oriented around a hieratical division of interests and institutional power, as this respondent notes:

I04: “In the NFC project, there were cards, mobiles, validators, 3 main parties, but during the promotions, they didn't mention our name. There are also such things. For a reason, they didn't even want to put our name, even in miniscule characters. That building didn’t go anywhere.”

These institutional pioneers draw or demarcate roles on the boundaries of infrastructure and in effect post ‘keep out’ signs to prevent others firms building or challenging the organising of the digital platform infrastructure. Here the digital platform infrastructure is the key way of organizing, defending and maintaining boundaries.

W11: “...SP ended up developing technical plans that were unrealistic (ii). Each operator had special technical interface requirements, which led to an overly complex technical architecture.”

Business model configuring. According to the data, the dimensions of the business tension are related to business model uncertainty. The data show that the gap between the processes and their realization methods increases the likelihood of business process tension. That is, faced with the uncertainties in digital infrastructure-building, the gap between the collaborative expectations and the real business conditions generate businesses process tension as stated by the Financial Services Manager of TC:

I24: “Second, the business model is not clear yet (i). Still, there is a question mark in everybody’s mind. These are postponed in order to run the pilots, but when a commercial implementation is considered, these come back to the surface and it... it creates a situation that cannot be resolved.”

In the above quotation, the business model uncertainty generates tension through the ambiguities regarding income sharing, consumer satisfaction, and consumer ownership as the interviewee refers to them as “commercial implementations”. However, when institutional pioneer actors insist on dominating or following strict guidelines in organising and impose their own models or templates, others began to push back, as the interview with the manager of a GSM operator reflects:

I24: “Our aim is to make them start working on the business models. We want to create the models for the industry. For that reason, we are not in a position to wait for the banks. Therefore, not all ... applications are bank dependent... they focus only on banking applications; they see the rest as extensions, like transportation, etc. But, we see them as market opportunities. Consequently, we do not have to wait for the banks there.”

In this excerpt below the level of tension is produced from reflexive asking themselves “hard questions”. In this example, once again the business model is uncertain:

W40: “Without a cut of the transaction revenue, mobile telcos are asking themselves hard questions about the business case (i) for NFC. They don’t have complete answers, yet. This is the main reason, say observers, the telcos have delayed ordering phones that include NFC chips and why handset makers have yet to begin producing them in anything more than sample quantities.”

I15: “First, we worked quite hard as for the technical part (of it), (with) MC, MC’s certifications, many of which we formed... MC was ready but we said to them “look we do it that way... We work very close also with G., with the card vendor, I, V., and POS vendors. ...we all sat down and determined... the standards together. The sentence I used may seem a little... ostentatious. If not, say “identified the standards”, we at least assisted all the parties in the sense of our experiences.”

While we can only present two subthemes to space constraints, additional institutional pioneering influence tensions are presented in Table 5.

INSERT TABLE 5 ABOUT HERE

Summary: Institutional pioneers are at the foreground of influencing the digital infrastructure-building. These actors influence the organizing dynamics of shifting action cycles, both triggering and escalating social tensions but also breaking down many of the infrastructure-building task across multiple vendors and sectors.

4.3 Articulation work in digital platform infrastructure-building

The second part of the findings further deepens the invisible layers of articulation work in digital platform infrastructure building, by considering the informal, invisible resources for buffering the tensions of institutional pioneering influence.

4.4 Brokering workable solutions

Articulation work soothes institutional pioneer influence by brokering workable solutions and by prioritising the work of connecting different vendors across the platform. That articulation work comprises all of the behind the scene engagement work on developing workable solutions for practices, processes repositories, specifications, and standards that support the digital platform

infrastructure-building. Each platform building vendor was aware of their own work requirements in this regard, yet needed to work with others to fully understand the more tacit and 'invisible' knowledge and resources, as the following quotation suggests:

I06: "As an operator, I am supposed to connect these two organisations, the bank and the firm using Mifair in some ways. The communication generates here, I am trying to find a solution there.

I24: "...the mobile world is completely the opposite. It is more unstructured. Faster progress is in place through immediate launching, immediate starting of the eee... product cycle... From our perspective, banks are too slow everything proceeds through procedures ... Actually, overcoming is not that possible. That is a bit in relation to the institutionalization of the organisation."

This brokering allowed for them to 'fill in meanings' across the sector vendors by enabling individual community members to acknowledge and appreciate the other community's perspective. That allows for localized knowledge to be transformed into jointly produced knowledge that transcends each community's local interests. Delegated, assigned or agreed-upon responsibilities almost always permit some degree of discretion, just as they entail accountability for task accomplishment. On occasions, the vendors sought to avoid tasks and duties:

I06: "In the end, I am subject to the rules of MM and VV, but to avoid them, I am trying to give the responsibility to another firm at the moment. But this is the core business of the banking industry.

Brokering workable solutions can also play an important buffering role by removing the human complexity from problems to present groups with professionally "pure" problems and they clarify the roles of the different groups in the creative process. The below quotation from an online data source expresses the manifest conflict:

W17: "Now the mobile service providers want to displace the card brands and banks But even there the partners will have to figure out how to share the upside; even assuming they can convince the retailers they will be better off using a mobile-based contactless payment system."

4.5 Interactional alignment

The second subtheme emerging from our data analysis centred on the alignment whereby platform vendors fit together their respective work. Infrastructure-building requires interactions before and after to articulate specific tasks on which it depends or which depend on it. The organization of

infrastructure-building required temporary spatial clustering activities and trade association voices.

Temporary spatial clusters. A key aspect to the articulation work had been the interaction between participants through series of formal processes such as workshops and conferences. These allowed for new stories; set actions in motion; announce beginnings, milestones and ends; and trigger changes of course. As the following participants highlighted:

W11: "The technical teams from banks and telecoms had very different mind-sets, used different terminology, and worried about different technical issues. Over time, tension arose with participating banks that increasingly saw SKT's m-cash accounts as an "invasion of an outsider into their business domain"

W40: Mobile network operators and banks have regarded each other with suspicion for years (ii), ever since the first mobile payment services launched in the 1990s... except in such countries as Japan and South Korea where mobile telcos have aggressively gone after payments, the tension between operators and banks has largely remained under the surface (iii) because mobile payment has failed to catch on. That is starting to change and signs of the old rivalries are flaring up (ii).

Trade associating voices: Trade associations played a key role, inhabiting regulatory agencies and attempting to influence policies at various regulatory levels, seeking to construct them in ways that favour and help secure their interests. The digital platform infrastructure-building also comprised firms actively working through the Trade Association to pursue bargaining relationships with different sector interests across the digital platform. Most of the issues required interpretation as they are applied to specific situations and therefore, 'only in specific contexts is the meaning of identified rules determinately defined. Conceived in this way, it entailed an exchange of proposals between parties, which mediate conversations and dialogues and enable parties to discuss tasks not yet executed and outcomes that still have to be created.

In both activities, interactional alignment involved processes of arguing, listening and working to reconcile differences enabling individuals to 'express their opinions and beliefs, engage in

constructive confrontations, and challenge each other's viewpoints'. In this way, participants in collaborative relationships come to share and synthesize knowledge sets, implicit assumptions and mental models. These attitudes usually come from partners who have a strong preference for how the platform works and who are not acting mildly or backing away in view of sometimes contradictory ways. The data suggest that these partners are not necessarily the market leaders but are the challengers. Their strong desire to be involved in the creation of the digital infrastructure is the major driver as the managing partner of this software company explains:

I27: "We became the first certified developer in the market. We don't work only with banks. We work with municipalities. We know that we have a strong case for this product. It takes time, but we believe we will win in the end. This product benefits all parties."

To achieve this, there must be an understanding of how technology not only works together but how the vendors can work together in infrastructure-building.

4.6 Workarounds and backstops

The final sub-theme of how articulation work soothes institutional pioneer influence relates to what we term workarounds and backstops.

Backfilling. Despite the design-led efforts of the six banks, together with the regulating authorities in the card business, some task community projects of the digital platform infrastructure-building never 'got off the ground' because of social inertia. To overcome this social inertia, is common when actors do not conform to activities of others and stop working on the common tasks for a while as the marketing manager of a solution provider explains:

I19: "Therefore, when somebody thinks that he is the only solution provider for that area, this produces inertia. I mean, they make working together almost impossible. We can't go on producing a new service. We need more solution providers to achieve an equilibrium."

Low levels of digital platform organising happen due to the limited levels of tensions. This social tension demands a workaround whether that is in relation to the business model, standards, the technology or standards. The excerpts below from an interview with a bank manager describes this situation:

I07: "...in 2008 the devices were ready, but we couldn't manage to sign any contracts with the 70 local authorities visited over a three month period. None of them was convinced about the project! The reason for that was the lack of any models running to prove the project...This didn't stop us. Actually, it triggered our motivation. In the end, we secured a pilot, for a limited number of service stations for three months. That was enough."

I01: "Especially at times when stressed repeatedly on some matters they do not step back, discussions break out and turn into verbal or written warnings. i.e. though BBB Business Development is a lower level platform."

The quotation first expresses the relational tension; resistance by refusing to enact the project, despite the cost waivers from the other party. The productive strategic and relational tensions can be seen in the persuasion techniques used by the actors, and in their enthusiasm for the project. This quotation also shows how unproductive tension slows down infrastructure-building activities ("three months" and "limited numbers" of service stations).

Having a safety net or backfill prevents a dominant partner's 'thought leadership' posturing, declarations and decisive efforts fully undermining digital infrastructure-building. This backstop position can produce competing logics and help to disrupt the status quo and ensures that the initial work was driven forward, as the following excerpt from an online data source explains:

W14²: "DCM also recognized the challenge... it will seek to cooperate more closely with banks and card companies to further expand... In 2007..., X agreed to make their readers interoperable."

Evidence of the resentments associated with tensions, specifically when some partners imposed or forced the ‘trading up’ of expectations and change perceived feasibility, were present as highlighted below:

I27: “...with continuous warnings... we told them “this is the way we work, if you adapt we can proceed. Otherwise, it means we stop here.” We notified them... well... regarding our working principles and expected them to obey...”

The interview with the manager of the payment cards central authority provides an insight into inertia dynamics:

I11: “...so, finally, this happened, this... under this formation six banks said yes we want to go on with this project through BBB... We carried some communications with TC on behalf of those banks... but this didn’t happen; with TC... a deal with TC was not possible...”

W11: “Octopus (a Hong Kong based collaborative product) is also a stored-value smartcard, but it was launched with a much narrower ambition (ii): as a public transport ticketing system. It excelled at this niche application (ii), in no small part helped by very favourable ticket pricing schemes... This model is being replicated by mass transit consortia in many countries.”

The majority of respondents highlighted the complexity of the discomfort experienced with incompatibilities over their firm vision, goals, and standards:

I24: “It is very difficult to find a business model which offers win-win-win to everybody, as there are many parties”.

I06: “...it can delay. MC is doing a certification, which needs to be followed, and this certification can last three months. However, I need to go live immediately!”

I09: “The key issue is that most of the biggest players in the space are the banks, mobile operators, and technology providers. As the commercials associated with contactless produce smaller profit/revenue opportunities, this is causing the business case to fail and all involved in the delivery chain to put key initiatives on the 'back-burner'”.

Summary: While institutional pioneers might be at the foreground of influencing the digital infrastructure-building, these backgrounds and behind-the-scene actors equally influence the

processual dynamics of digital infrastructure-building, both organising and soothing the social tensions of infrastructure-building tasks across multiple vendors and sectors.

5. DISCUSSION

Star (1999) suggests that studying platform infrastructure is not particularly an exciting topic in research but nonetheless necessary to understand how digital platforms come to emerge and operate. Our aim is to show that platform infrastructures are not only technical systems but are socially constructed by both frontend and backstage actors. In this paper we explore the narrative beyond the dead technical lists associated with digital infrastructure-building and show the social practice of digital infrastructure-building. As such, the paper departs from much of the business and management literature which views the dynamics of infrastructure from the ‘high grounds’ of methods and control systems (Ciborra, 2000). Rather, this study shows how mundane struggles and tensions are part of the social fabric of digital infrastructure-building, with the building work digital platform infrastructures are not done within a vacuum but linked to what already exists. In this study, our findings revealed some answers to three questions: i) what is the nature of institutional pioneers’ influence (how might that produce tensions)? (ii) what kinds of tensions arise in digital platform construction? (iii) how might the work of articulation work function in digital platform infrastructure-building?

Institutional pioneers and digital infrastructure-building. The findings suggest that digital platform infrastructure-building comprises institutional pioneers formalizing conditions during what researchers refer to as ‘the era of ferment,’ where multiple alternative views about the meaning and usefulness of the digital platform can coexist (Kaplan and Tripsas 2008) and where opportunities are up for grabs in terms of defining the digital platform rules of engagement, interdependency, socialization, learning and emulation. constrain and shape emerging

possibilities. However, studies also show that institutional environments are plural (Kraatz and Block, 2008), with complexities and contradictions that compel reflexivity and enable actors to question taken-for-granted meanings and organizational conditions, and challenge the status quo (Greenwood et al., 2011). Nowhere is this more evident than in the interplay among The institutional pioneers, we find, frame those infrastructure-building opportunities by energizing new directions for building, discovering of digital platform network goals and theorising roles and positions, while also staying committed to their own epistemic stance. However, in making that ‘stance commitment’(Fayard et al. 2016), through developing working hypotheses, institutional pioneers also produce tensions, some of which are productive and unproductive. Indeed, developing likely epistemic implications of a new digital infrastructure and efforts towards formalizing those epistemic stances adds to the pressures where institutional pioneers’ actors try to manage and stabilize exchanges between infrastructure-building actors. Formalization refers both to the process of codifying and enforcing inputs, outputs and behaviours (Ouchi 1979). Institutional pioneers seek to formalise the rules of engagement through the digital infrastructure-building efforts. Digital platform infrastructures therefore cannot be defined through a distinct set of functions (unlike specific systems), or strict boundaries (unlike applications) (Tilson et al., 2010) or even through strict types of institutional actors. However, we show that pioneer influence is not always characterized by conflict or overt antagonist, but more often simmering tensions from the jostling and unsettling of infrastructure provisions. Institutional pioneer aspirations and ambitions can stifle other platform infrastructure makers. We find evidence how this throughout the data analysis and this can be discouraging, debilitating, if not deadening for those left out in cold.

Digital infrastructure-building tensions. We observe from the institutional pioneers that institution approaches are often formed in earlier times and places (Berger and Luckmann, 1966), and consequently produce tensions. Institutional pioneers are challenged with incorporating, combining and managing sometimes contradictory and competing interests and visions in digital infrastructure-building. Smaller specialized firms' and entrepreneurs' fluid actions reside at the heart of these dynamic relationships tensions (Kuhn and Galloway, 2015). We find that institutional pioneers remain committed to their stance to (re)frame and evaluate core characteristics of the new infrastructure-building practice That, in turn, generates new tensions around the meanings, framings, and constructions of a new infrastructure practice, especially in the absence of ready-made interpretations or a well-developed organizing vision (Fayard et al. 2016). Three main tension types are identified from the reasoning of the infrastructure-building actors – strategic, social and relational – which challenge those, who are involved, to search for a compromise and synthesis; somewhere between the extremes where interests can co-exist (Pinkse and Groot, 2015). In social terms, working on social consensus requires enthusiasm of most actors. In relational terms, social practices that address both individual (entrepreneurs), meso (firm level) and collectivist (market level) norms, together with the nurturing of relative *quid pro quo* understanding that encourages all actors to show they actively participate. Overall, the findings on the different tensions demonstrates that it is not always possible or appropriate to 'jump to solutions 'and digital infrastructure-building require an understanding of the social trade-offs regardless of the size or experience of the firm or individuals.

Other studies have emphasized instability in relation to practices such as value co-creation, cooperation, and competitiveness (Das and Teng, 2000; Pinkse and Groot, 2015). However, this perspective ignores how articulated work tensions might positively impact practices by

encouraging creativity, innovation, original business models and new market creation within simultaneous competitive and collaborative situations. In dynamic co-opetition practices, the meaning is negotiated, produced and shared through participation in social practices (e.g. conferences, forums, workshops, meetings, site visits), as fluid and shared ways of thinking (e.g. brainstorming, tips) bringing together the various pieces of an incomplete puzzle. Yet, alongside shared meaning, vested interests, emotional states, values and power relations develop (Soekijad and de Joode, 2009, p. 152), centred around specific market expectations, goals, motives and desires (i.e. logics) can hinder opportunities to create new collective knowledge (Bouncken and Kraus, 2013). From this point of view, the distinction between front-facing (downstream) and backstage (upstream) provides an analytic both as a means of understanding the dynamics of working relationships as well as the organising task of building digital platform infrastructure (Star, 1999; Gerson and Star, 1986).

Articulation work soothing. Articulation work may be seen as an approach for exploring the unplanned aspects of work frequently left out of design-led models (Star and Strauss, 1999), however, the findings point to the way that both design-led models and brokering provide a bridging mechanism to align with and complementing one another. The findings show how articulation work, that is, brokering around workable solutions, interactional alignment and backfilling, play an important buffering role by removing some of the human complexity from problems (Abbott 1981 ; Barley 1996 ; Barley and Bechky 1994 ; Heimer and Stevens 1997), and they clarify the roles of the different groups in the creative process (Lingo and O'Mahony 2010 ; O'Mahony and Bechky 2008). Field arrangements play an important role in soothing the transition by acting as important brokers for connecting academic groups by engaging in what Carlile (2004) calls "transferring, translating, and transforming." Brokers transfer information

across groups by developing work practices, repositories, specifications, and standards that support communication across boundaries (Fernandez and Gould 1994; Fernandez-Mateo 2007; Hargadon and Sutton 1997; Reagans and McEvily 2003). They translate meanings across groups by enabling community members to acknowledge and appreciate the other community's perspective (Huising and Silbey 2011). And, they transform tasks across groups by facilitating a process of negotiation that allows localized knowledge to be transformed into jointly produced knowledge that transcends each community's local interests (Carlile 2002, 2004).

The empirical setting of digital infrastructure-building provides important theoretical insights into institutional theory. It provides theoretical definition on the nature of institutional pioneers as well as the multiple background actors, both of which inhabit and work within institutions to influence digital infrastructure-building. In particular, the study provides theoretical insight into institutional pluralism, which produces complexities and contradictions that compel reflexivity and enable actors to question meanings, platform direction, network goals. At the same time, it shows the institutional brokering practice around workable solutions, interactional alignment and backfilling, to buffer emerging institutional rigidities. The study, moreover, highlights the way that the normative convergence –divergence tensions can become a lively talking point and consequently become contested isomorphic processes (Lok and De Rond, 2013). Normative judgements therefore play a powerful role of in appraising and influencing what behaviours or practices meet with approval or disapproval in digital platform infrastructure-building. In doing so, we contribute to the social psychology perspectives on legitimacy and a sub-set of the institutional literature (Bitektine, 2011) to develop an understanding of how institutional actors 'handle' digital infrastructure-building vis-a-vis normative judgements, negotiations and search for compromises. This sheds light on the internal convergence dynamics of legitimacy-claiming – a perspective from

within rather than a perspective of external stakeholders – and analytical variation in forms of invisible agency beneath the more visible, but one which nonetheless bears a significant “mark of the larger institutional waves that flood them” (Hallett and Hawbaker, 2020: 7).

6. CONCLUSION, LIMITATIONS AND FUTURE RESEARCH

In this study, we aim to demonstrate that digital platform infrastructure is not just technical; they are institutions designed to organize collective behaviour. The mobile payment platform provides interesting conditions to understand infrastructure-building given the number of applications aimed at a semi-functional (secure) and semi-sectorial segmentation (e.g. banks, retailers, governments) actors (M’Chirgui, 2009). Tilson et al. (2010) refer to digital infrastructure as the orphan of the information systems field. Traditionally, digital platform theorizing has been left to economists (network effects, information asymmetry, two-sided markets, patterns of technological change) (Arthur 2009; David 2005) and to legal scholars (forms of information creation and distribution, intellectual property and control) (Lessig 2001; Zittrain 2008), or to consumer marketing academics (Martin and Todorov, 2010). Some researchers have asserted, largely without formal evidence, that digital infrastructure-building is a single well-trodden route, marched along by one large tech behemoth with a range of supporting and identical firms. Our findings cast doubt on this assertion. The practice of platform infrastructure-building, we find, is a dynamic social practice, with demanding behaviours across long periods of time with different tensions related to the social complexities of business exchanges. Ultimately, these platform infrastructure-building actors are not seen as competitors, but complementary of wider trends at work within the marketplace. Through the three different tensions – strategic, social and relational – industrial organisations can understand differences between diverse infrastructure-building tensions while achieving their tasks. This allows both industrial actors and entrepreneurs to be

aware and ready for multiple, often incompatible, logics and accordingly develop work interactions. Our findings point to importance to consider the building and maintaining of digital infrastructures and platforms as not only technical but also as social activities. For instance, the literature in the field of industrial ecosystems (Hannah and Eisenhardt, 2018; Ganco, Kapoor, and Lee, 2020) and organizational field (Grodal, 2018) show that the emergence of an ecosystem is the outcome of the work of various actors who may compete against each-other, but they all cooperate with each-other to create and grow of the ecosystem by defining the underlying institutional arrangements. Defining the institutional arrangements of an emerging ecosystem is inextricably linked to identifying and soothing the tensions between the actors as their interests tend to misalign in the beginning. Therefore, aligning these interests often require a social-relational approach to ease tensions out. This is a particularly important finding for SMEs as they tend to be smaller actors who must conform to the working of larger organizations. Identifying the tensions in the emerging field can help SMEs conform earlier and be recognized by other actors as appropriate entities.

Our findings contribute to advancing the institutional literature by unravelling the social dynamics that are specific to the ecosystem of digital platforms. As ecosystems are purposive and value-creating networks where participating actors co-create value (Adner, 2006; Adner & Kapoor, 2010), and they are shaped by external pressures stemming from industry norms, mimetic influences, and regulations as set by the institutional arrangements in place (DiMaggio and Powell 1983). Digital platforms constitute an emerging ecosystem as actors including customers, merchants, intermediaries, network operators, and hardware and software providers cooperate and compete to create value within a system of values and norms that are specific to the ecosystem's institutional life (Du, 2018). Ecosystems have different institutional logics than markets as the

overall value creation depends on the collective actions of all actors and their underlying inter- and intra-firm relationships (Windahl & Lakemond, 2006), which implies that the social dynamics tend to be highly complex and idiosyncratic (Thomas & Autio, 2014), and as such needs in-depth investigation to comprehend the construction and structuring of meanings and values in the early stage. Our findings unravel the ways the various actors in the nascent mobile payments ecosystem compete and cooperate to navigate through the complexities of business exchanges by resolving three types of tensions (strategic, social and relational) through collective articulation work. The tension-resolving articulation work by institutional pioneers in this study brings novel insights to the literature on the shaping and structuring of institutional arrangements in a nascent digital ecosystem. A particular area of novelty in our findings is that we focus on the very early stage of ecosystem formation where meanings tend to be negotiated between emerging actors rather than being legitimated by leading established actors and mimicked by followers. This focus resonates well with the digital literature as many digital ecosystems are still in the emerging phase, thus our findings bring valuable insights into the ways actors can work collectively to resolve early critical tensions. Another facet of our contribution lies in a better understanding of the emergence of ecosystems in the digital economy. Digital platforms differ from traditional markets in that they are typically more complex, multi-sided, and embark a complex interconnection of technologies from various industries such as telecommunications, mobile and wireless networks, applications, software, and banking in our research, which renders this type of ecosystems more challenging to capture. In such a complex environment, past research has suggested the critical role of institutional entrepreneurs in building the foundations that enable the emergence and growth of digital ecosystems (Hu et al., 2015). Although the important role of institutional entrepreneurs in the emergence of traditional ecosystems is well-informed in the literature (Déjean et al., 2004; David et al., 2013), the role of these entrepreneurs in digital ecosystems requires further research

to understand how they navigate through the complexities of digital platforms and infrastructure, which by essence are open systems with porous field boundaries and rapid-changing institutional arrangements (Sussan & Acs, 2017), to propose and build a consistent set of meanings and values for the vast community of actors. Our study elicits some of the specificities and complexities of digital ecosystems by showing the numerous tensions that arise in the nascent stage, and offer some directions for actors to institutionalize the new meanings and values.

In more practical terms, rival firms can collaborate in digital platform infrastructure-building and pool resources allowing, for example, to share R&D costs, reach final results faster, foster learning and, influence potential customers across different sub-fields (Kuhn and Galloway, 2015). Similarly, while Apple and Samsung are competing in the smartphones market, Samsung is still producing semiconductors for Apple phones and together they are developing the E-SIM market. In either case, that infrastructure-building activity may be cast with different reference points, in profoundly divergent ways, with debates and contestation with multiple market actors. Discussing the notion of ‘generativity’, Tilson et al. (2010) explained how self-contained systems to create, generate, or produce a new output, structure, or behaviour without any input from the originator of the system – pushed the emphasis away from the few to the many. Digital infrastructures have been enabled by (a) lower costs and global reach encouraging wide participation in service production and distribution (e.g., open source), and (b) new market conditions created by multisided markets (Tilson et al., 2010). “If infrastructure is needed for an industrial economy, cyberinfrastructure is required for a knowledge economy”; between the base technology and its use are intertwined arrangements of “enabling hardware, algorithms, software, communications, institutions, and personnel” (Atkins report, 2003).

We provide an analysis the information systems tradition on infrastructure-building (Tilson et al., 2010) and develop this with an institutional lens (Hinings, Gegenhuberb, Greenwood, 2018) in conjunction with the concept of articulation work (Strauss, 1988). Gerson and Star (1986) refer to articulation work as consisting of “all the tasks needed to coordinate a particular task. No matter how detailed the requirements are, they must be aligned with or tailored to a set of implementation conditions that cannot be fully specified ahead of time” (Gerson and Star, 1986, p. 258). Accordingly, we understand articulation work as the work done by the backstage market actors, technicians, advisors, administrative and other help (Daniels, 1987; Shapin, 1989).

As digital infrastructure-building can occur over years or even decades, it is important to explore how such activities are dynamically developing and also maintained. Understanding how different actors from all business sizes and from different sectors socially interact, influence and disrupt one another when operating business is important. Industry instances include smartphone payments initiated by Apple’s “ApplePay” and Google’s “AndroidPay” which often enabling better operations for smaller entrepreneurs (e.g. lower fees, shorter contract time) while being resisted by larger firms as they disrupt their traditional established (gate-keeping) market practices. Small startups (e.g. Dueapp, WePay, GoCardless etc.) can often lead the field ahead of larger more established players but that does not mean they are part of the final infrastructure. Overall, our research shows that, although the current and large digital platforms may appear as independent actors in their respective field, they are actually much more inter-dependent (Jovanovic, Sjödin, and Parida,2021), are influenced by similar institutional logics governing the digital infrastructures, and face similar tensions that need to be resolved for the field to grow and survive. Understanding the social dynamics of digital infrastructures is key to study the purposes and behaviors of digital platform actors.

However, no research is without limitations, and results must be interpreted with caution. The first limitation comes from the research design. Relying upon a qualitative method to investigate a phenomenon produces constraints. In order to avoid these limitations, systematic data collection, across multiple domains, quantitative data analysis, and conceptualization techniques could be used. Another limitation stems from the “small number” phenomenon of digital infrastructure-building. The entrepreneurial activity in mobile payment market results in fewer numbers of established organisations that are registered to state-owned statistical lists. Consequently, there is no specific Standard Industrial Code (SIC) listing of ‘the platform’ to sample. The findings also point to the important role of market-configuring events that ought to be better identified in today’s digital economy whereby start-ups, in particular, have further avenues to coordinate and share information across upstream and downstream environments. Beyond shedding light on the conditions which articulation work happens, it would be worth investigating how competing ideologies in the institutional platform realm, that is, “beliefs held by actors underpinning a preferred social order” (Barrett et al. 2013, p. 203), interplay with the epistemic stances of platform infrastructure-builders. Finally, an area for further research could be to show the relevant differences and similarities between front-end and the back-end digital platform infrastructure-building practices. Studies could usefully capture how connections between the different practices become entrenched and established through processes of institutionalisation.

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Table 1 Field observations and delegates at mobile payments industry conference (conference 3)

Europe (France included)	50.5%
North America	15%
Middle East / East	10%
South America	8.5%
Asia	6.5%
Africa	5.5%
Undetermined	4%
Vice-President/ Director/ Head of Department	37,4%
Project / Product Manager	21.3%
CEO/ DG/ Gerant	14.8%
Engineer / Executive	12.5%
Technician/ Supervisory manager/ Employee	7.7%
Consultant/ Trainer	6.5%

Source: <http://www.cartes.com/The-conferences/Overview-2010/Conference-Delegates-in-2010>

Table 2 Characteristics of the respondent platform infrastructure-building firms

	Market experience		Payment System experience		International Experience		Entrepreneurs
	New	Established	Yes	No	Yes	No	Number of firms
Financial Institutions	√	√	√		√		3
Software/Hardware Companies	√	√	√	√	√	√	3
National Regulatory Cooperations	√	√	√		√		1
International Regulatory Cooperations	√	√	√		√		2
GSM Companies	√	√	√		√		2
Transportation Companies	√	√		√		√	1
TSMs	√	√	√	√	√	√	3

Source: Field data

Table 3 Illustrative Data Analysis Coding Process

Phase	Explanation	Example
1	Initial coding for 1 st order emergent themes	“Strategic focus”, “partner expectations”, “domination”, “active persuasion”
2	Shifting of 1 st order themes and recycling between the data and the literature	“resistance”, “annoyance” > frustration “using acquaintances” > lobbying
3	Development of 2 nd order themes	Frustration > Relational tension concept Lobbying > Political tension concept
4	Semiotics	Signifier (original narrative): “Developing own standards to respond to the threat” Signified (real meaning): “To impose own model during the creation of marketplace to exploit the revenues in the future”
5	Typology development	Level of market place creation under the combined impacts of cooperation tensions

Table 4: Summary of Findings: Institutional pioneer and articulation work in digital platform infrastructure-building

Institutional pioneer digital platform infrastructure-building work	Institutional pioneer digital platform infrastructure-building work tensions	Articulation work in digital platform infrastructure-building
<p>Themes</p> <p>Energizing new directions for building</p> <p>Institutional pioneering work questions:</p> <ul style="list-style-type: none"> • how things are currently done, • why that is restraining and stifling provision and what needs to be done 	<p>Themes</p> <p>Strategic</p> <p>Strategic tension is produced from the institutional pioneers agency in establishing strategic activities and strategic actor involvement in infrastructure-building tasks.</p>	<p>Themes</p> <p>Brokering workable solutions</p> <p>That articulation work comprises all behind the scene engagement work on developing workable solutions for practices, processes repositories, specifications, and standards</p>

<p>Discovery of digital platform network goals.</p> <p>The institutional pioneers elicit and settle network goals and force parties to articulate their individual visions and discover mutual goals explicitly</p>	<p>Social</p> <p>Social tension is generated when institutional pioneers try to <u>influence</u> the infrastructure-building through their social ties. They use several social practices to achieve this, such as homophily, the democratic lever such as votes or persuasion.</p>	<p>Interactional alignment</p> <p>Infrastructure-building requires interactions before and after to articulate specific tasks and requires:</p> <ul style="list-style-type: none"> • temporary spatial clustering activities and trade association voices.
<p>Converging competing agendas</p> <p>The experiences of the mobile payment vendors show their mission to “lead the competition”, and “shape the market” which brings reactions from the other digital vendors jostling for saliency and status.</p>	<p>Relational</p> <p>Relational tension is produced through the discrepancies between the strong personal attachment to the goals and the general attitude of the other partners’. Relational tension is observed in personal preferences, approaches to processes as well as in platform infrastructure building tasks. Relational tension can be observed through the differing expectations (individual vs. collective), Quid pro quo vs. merit/transactional or avoidance versus participation.</p>	<p>Workarounds and backstops</p> <p>Some task community projects of the digital platform infrastructure-building are subject to social inertia which is common when actors do not conform to activities of others and stop working on the common tasks and network goals.</p>
<p>Theorising roles and models</p> <p>Role positioning identity</p> <p>the institutional pioneer formalises the articulation of the digital infrastructure-building roles, models, and standards:</p> <ul style="list-style-type: none"> • jostling, • expulsion and second • protection of autonomy. <p>Business model configuring</p> <p>The dimensions of the business tension are related to business model uncertainty. And the gap between the processes and their realization methods increase the likelihood of business process tension.</p>		

Table 5: Institutional Pioneers' Digital Platform Infrastructure-building Tensions

Themes elicited from the data	Explanation	Illustrative excerpts from the data (see note a and b)	Interpreting institutional dynamics of infrastructure-building pioneers
Strategic tension focus	Actors focusing on infrastructure-building engage in strategic activities such as persuasion, domination and partner elitism. This variance in ambition produces tensions between the more demanding, radical, expedient, active entrepreneurs and those actors more ambivalent, reluctant, incremental, and cautious when moving forward. Infrastructure-building tensions accentuate the interdependencies, but also prepare the way for strategic clashes over the vested and sensitive interests of individual firms. Here the boundaries between large and smaller firms were revealed.	W41: <i>“This grouping is not likely to last long, nor will it make much of an impact while the companies stick it out,” says E. S. There are many obvious hurdles. Retailers will have to be convinced to play ball... Each participant in the new ecosystem will try to garner as much... value as possible, and that always means disagreement...”</i> I04: <i>“In the NFC project, there were cards, mobiles, validators, three main parties, but during the promotions, they didn't mention our name (or)even want to put our name...in minuscule characters. That business didn't last and fell apart.”</i>	Institutional actors sought to energize the pace of the infrastructure-building with strategic jostling in defining the network goals and value. Institutional actors sought to selectively include/exclude in strategic infrastructure-building groupings, with independent-interdependency boundary-setting issues arising from (non-) mutuality.
Social tension focus	Typically, formal and informal relationships occur inside and outside specific infrastructure-building projects, such as industry events, meetings, conferences, trainings, and award ceremonies. Here the ‘social things’ – identities, ties, objects, IT artefacts etc. of both material and non-material nature – are in a precarious, fluid state and bring out social -splits and schisms as well as cliques and cabals- with contrasting heterogenic features. There is a struggle for social authority and stronger positioning when uncertainty clouds the future, and when there is a need to comprehend, shape and control turbulent market opportunities. They required performative actions: talking, influencing, monitoring, persuading, handling and ‘getting to grips’ with relevant social dynamics, leveraging lobbyists and arbitrating social relations.	I03: <i>“With my vote and with the votes of other small banks we chose A as the President. Y got furious and so on... “How could this be?” Such absurd words like “ON is still effective!”. They took it from their side... They said that “we do... that... the ON... Banks united together...”</i> I03: <i>“They became really mad; he (Y) even left the meeting, because we were smaller, but got together and blown him off his safe place. At the end of the day, we may be smaller but we are more experienced in these types of manipulative tactics, and we know each other very well.”</i>	Inter-industry group hoarding occurred where different unorganized industry groups of individuals came together and developed social order. Institutional actors sought to bring their voice to the adoption and adaption of ideas on the digital platform infrastructure-building. Institutional actors sought to engage in social gatherings to manipulate decision processes through numerous tactics including, mobilization, democratic processes and co anti-leader positioning and counter-mobilization of ideas.
Relational tension focus	Actors use several methods to strike a balance between platform, firm level sensitive knowledge and individual expectations. An indicator of this is the enthusiasm for rapid decision making and implementation balance. The expectation that businesses or individuals will strive to bring about	I07: <i>“We believe in our project. We know that if we convince them we will be successful. Therefore, even if they say that they are not interested in our project we insist. We take them to our other partnerships to demonstrate how we work. We don't let go easily; although sometimes they don't like</i>	Institutional actors sought to pioneer and lead by positioning, demonstrating and getting others to emulate and learn from this practice.

	<p>an overall vision of the emerging market suggests that a strong relational emphasis on <i>quid pro quo</i> practice, where one transfer is contingent upon the other. The data show wariness between those ‘taking’ and those that ‘give and take’</p>	<p><i>our methods. We try until we get the project done.”</i> I11: <i>“There is a strange equilibrium in the management of this cooperation... the balance needs to be protected. They have the mission to drive the industry, to bring out new ideas, but also to intervene if any partner goes beyond the set goals. There is usually a common consensus on decisions in terms of market growth and innovation.”</i></p>	<p>Institutional actors sought to bring familiarity to the digital infrastructure-building practices whether that is in relation to developing standards and business models.</p>
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Source: Field Data

- a) We defined evidence as strong when it was consistent both within and across the interviews and artefacts. We considered evidence as moderate when it was consistently supported by clear examples and descriptions in either the interviews or the artefacts (out of 212), but not both.
- b) Interview excerpts are closely paraphrased accounts of the interviewees as they appear in our interview notes. Artefacts are quoted verbatim as well.