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Boriana Rukanova

TU Delft, Delft, The Netherlands, b.d.rukanova@tudelft.nl

Mark Reuver

TU Delft, Delft, The Netherlands, g.a.dereuver@tudelft.nl

Stefan Henningsson

Copenhagen Business School, Denmark, sh.itm@cbs.dk

Fatemeh Nikayin

UL Transaction Security, The Hague, The Netherlands, fatemeh.nikayin@gmail.com

Yao-Hua Tan

TU Delft, Delft, The Netherlands, y.tan@tudelft.nl

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OVERCOMING BLOCKAGES TO COLLECTIVE INNOVATION IN DIGITAL INFRASTRUCTURES: THE CASE OF MOBILE PAYMENT

Research paper

Rukanova, Boriana, TU Delft, Delft, The Netherlands, b.d.rukanova@tudelft.nl

de Reuver, Mark, TU Delft, Delft, The Netherlands, G.A.deReuver@tudelft.nl

Henningsson, Stefan, Copenhagen Business School, Denmark, sh.itm@cbs.dk

Nikayin, Fatemeh, UL Transaction Security, The Hague, The Netherlands,
fatemeh.nikayin@gmail.com

Tan, Yao-Hua, TU Delft, Delft, The Netherlands, Y.Tan@tudelft.nl

Abstract

Decentralized digital technologies increasingly enable multiple organizations to co-create digital infrastructures. However, collective innovation processes often come to a stand-still because of conflicting interests and business models. While existing research suggests various factors that block collective innovation processes, there is still little understanding of how organizations can overcome these blockages. In this paper, we identify patterns that explain how organizations overcome blockages of collective innovation processes for digital infrastructures. We follow a processual approach and develop a conceptual framework based on collective action theory. We evaluate the framework through a longitudinal case study on mobile payment infrastructure development. We find various reconfiguration processes that organizations use to overcome blockages of collective innovation. Theoretically, this paper contributes to the emerging body of research in the Information Infrastructure literature, which utilizes the collective action perspective and related models and frameworks to understand and explain underlying complexities in the digital infrastructures.

Keywords: Mobile Payment, Digital Infrastructure, Information Infrastructure, Collective Action, Unblocking mechanisms, Control Points

1 Introduction

Digitalization increasingly allows digital infrastructures (DI) to be composed of decentralized components controlled by different actors (Yoo et al., 2010). Therefore, decision rights are dispersed among different actors, which implies that artefacts have to be developed in collective innovation processes (Henfridsson et al., 2014; Ciborra & Hanseth, 2000). As such decentralized digital technologies increasingly enable multiple organizations to co-create digital infrastructures. However, collective innovation processes often come to a stand-still. While existing research suggests various factors that block collective innovation processes (De Reuver et al., 2015; Markus et al., 2006), there is still little understanding of how organizations can overcome these blockages. The main research question for this paper is: *How do organizations overcome blockages in collective digital innovation processes?* In this paper, we identify patterns that explain how organizations overcome such blockages. By following a processual approach we develop a conceptual framework based on collective action theory in combination with control points. We evaluate the framework through a longitudinal case study on mobile payment infrastructure development. We find various reconfiguration processes that organizations use

to overcome blockages of collective innovation. Theoretically, this paper contributes to the emerging body of research in the Information Infrastructure literature (Markus et al 2006; Rukanova et al., 2007; van Stijn et al., 2009; Constantinides, 2014, De Reuver et al., 2015), which utilizes the collective action perspective and related models and frameworks to understand and explain underlying complexities. From the point of view of practice, collective innovation processes for digital infrastructures are currently under way in different domains energy, healthcare, and international trade. Our framework and the unblocking mechanisms that we identified could be potentially useful and further applied to these other domains as well.

2 Theoretical Background

2.1 Digital infrastructures

Most digital infrastructures are distributed across a diverse set of actors to support information exchange across organizational borders (Monteiro et al., 2014). Developing DIs therefore raises inter-organizational coordination challenges that are highly political, with struggles for influence and control (Sanner et al., 2014; Henningsson & Zinner Henriksen, 2011). Developing DIs typically creates tensions of shared governance. The resulting losses are manifested across industries, including health care (Sauer & Willcocks, 2007), the payment infrastructure (Hedman & Henningsson, 2015; Henningsson & Hedman, 2014), in agri-food supply chains (Hedman & Henningsson, 2008; Hedman & Henningsson, 2012; Wolfert et al., 2010), and the struggle to introduce international standards for EDI (Damsgaard & Lyytinen, 2001).

As a consequence of dispersed and distributed ownership, digital infrastructures often lack centralized control (Ciborra & Hanseth, 2000). DI are developed by different actors in an incremental way and not all at once (Susan Leigh Star, 1999); they are a combination of both intentional design and the emergent nature of infrastructure (Karasti et al., 2010). Due to the challenge of distributed control, approaches different from the traditional system development methods are needed (Hanseth & Lyytinen, 2010; Tilson et al., 2010). As discussed Edwards et al. (2009) stakeholder groups rarely build an infrastructure from scratch, but they can nurture it and help it grow. An analogy for the DI development is made with cultivation, where “A cultivation approach acknowledges the existence of the installed base, and it seeks to address change in an incremental and gradual manner” (Grisot et al., 2014, p. 200). Ciborra (1997) emphasizes the unpredictability of this processes and argues that an organization “accumulates various unutilized resources often unintentionally as it grows and these resources represent potential for further growth though new, usually unplanned, recombinations” (Ciborra, 1997, p. 75). Constantinides (2014) recognize that digital infrastructures typically are constructed ‘bottom-up’. It is further suggested that a polycentric approach to governance might be further developed to promote the ongoing cultivation of information infrastructures from the bottom up. The process is further complicated as it is a subject of influences from multiple levels of stakeholders.

The discussion above pinpoints to the following observations. DIs are increasingly co-created by a number of organizations (Henfridsson, Mathiassen, & Svahn, 2014). The control over the infrastructure is not in the hands of one organization but different organizations preserve control of the parts. These parties often have conflicting interests and concerns and different business models in mind. As a result, collective action is increasingly required to develop digital infrastructures and platforms.

2.2 Collective action

While collective action has been widely applied in the field of sociology, economics, and natural resource management it has been applied to a very limited extent in the domains of digital infrastructures (exceptions being Markus et al., 2006) and emerges as a promising theoretical perspective to address challenges related to DIs (Rukanova et al., 2007, van Stijn et al., 2009, Constantinides, 2012; Constantinides, 2014). Collective action theory explains how people or organizations may collaborate for a common goal (Olson 1965). The object of collective action is a shared interest or goal (Har-

din,1982; Oliver,1993; Olson, 1971; Ostrom,1990). For instance, the object of collective action could be providing a good that is in the interest of all participants (e.g. Monge et al.,1998; Von Hippel and Von Krogh, 2003). Collective action can also be seen as a dialectic process for institutional innovation (Hargrave and van de Ven, 2006).

2.2.1 Blockages of collective action

Literature provides several factors that can block collective action. First, diverging interests between the participants of collective action may lead to blockages. While the object of collective action is a shared interest, organizations typically still have different interests as well (Kollock, 1998;Oliveretal.,1985). Different interests may arise, for instance, since actors are from different industries (Markus et al 2006). Diverging interests may lead to conflicts that threaten to block collective action (Klein & Schellhammer 2011). Therefore, reconciling diverging interests is critical to achieve collective action (Markus et al 2006). Second, conflicts between participants of collective action may lead to blockages. Conflicts are concrete instantiations of differing interests (Baland and Platteau, 1996; Streeck, 1990). For instance, when competitors collaborate for a common good, such as a common infrastructure, conflicts may arise during the process (Brandenburger and Nalebuff, 1997). Third, reducing interdependencies can take away the urgency of collective action (Walter et al 2012), thus leading to blockages. Interdependencies are generally a prerequisite for collective action to arise, as they create a rationale for collaboration (Heckathornn 1993; Marwell et al 1988). Lack of interdependency negatively affects willingness to participate in collective action (Monge et al 1998). Interdependencies may change along the course of collective action process, for instance as technological alternatives become available (De Reuver et al 2015). Fourth, lack of effective governance mechanisms between the participants of collective action may lead to blockages (Ostrom, 2000; De Reuver & Bouwman, 2012). Collective action literature stipulates the importance of leadership for attracting participants, maintaining momentum (Biancoand Bates,1990) and organizing joint action (Frohlichetal.,1971; Salisbury,1969). Leadership is also important for selecting the most capable participants in a collective action setting (Marwell et al. 1988).

2.2.2 Overcoming blockages of collective action

To understand how actors overcome blockages of collective action, as identified in the previous section, we will follow a processual approach in order to capture the processes of blocking and unblocking over time. The processual approach has been advocated in the field of organizational studies and more specifically in Pettigrew's contextualist approach to change (1985; 1987; 1990; 2001). In his approach Pettigrew argues that a study of change needs to be placed in its historical, processual, and contextual setting.

Looking at studies of collective action, Hargrave and Van de Ven (2006) take a process perspective and identify a number of processes central to mobilizing collective action, namely the framing contests, the construction of the networks, the enactment of institutional arrangements (political opportunities), and the collective action processes. Framing contests draw attention to the creation and manipulation of the meaning of issues. In the Information infrastructure literature, Constantinides (2014) also shows the key importance of framing for understanding information infrastructures. Hargrave and Van de Ven (2006) argue that the construction of the network is a second important element that plays a key role in institutional innovation change processes, as it refers to the mobilizations of the resources for starting up a collective action. The third element in the Hargrave and Van de Ven (2006) model refers to the enactment of institutional arrangements and links to political opportunities. These are efforts of the collective action participants to challenge political opportunity structures. These structures constitute formal and informal political conditions that encourage and discourage the collective action (Campbell, 2002). With insights from the technology innovation management literature, Hargrave and Van de Ven (2006) discuss the collective action processes, which describe the contested political process through which new technologies emerge. The collective action model of Hargrave and van de

Ven (2006) has been applied to analyze innovation processes related to the development of innovative digital infrastructures in the international trade domain (Rukanova et al., 2007; Rukanova et al., 2008, Rukanova et al., 2009; van Stijn et al., 2009). In this application specific attention is paid on further making explicit and capturing the complex processes of network mobilization by using a multi-level analysis. In this analysis the innovators' efforts are put at the center and the analysis gradually moves to capture other relevant actors nationally and internationally. While these studies show how the model of Hargrave and Van de Ven (2006) can be applied and extended, a limitation of the application domain is that the digital innovations under analysis have not been able to reach implementation stage yet.

2.3 Control points

As argued in Section 2.1, shifting interdependencies are an important blocking factor for collective action. To understand how interdependencies shift, the concept of control points is a helpful tool. Control points were introduced in DI literature and can be defined as a sociotechnical mechanism that expresses the boundaries of areas of economic control in the value network and enables the controller to exercise power over other actors in a socio-technical system (Elaluf-Calderwood et al., 2011). Control points are thus a source of interdependency in realizing the common good. The strength of a control point depends on four dimensions, see Eaton et al. (2010, p. 462): interchangeability (i.e. the extent to which control points can be replaced by other resources); demand (i.e. the extent to which a control point is required by other actors); value (i.e. the value the control point creates for other actors); and time (i.e. the durability of the control point).

2.4 Conceptual framework

In this section, we develop an initial framework for the analysis, informed by DI, collective action and control point literature (see Figure 1 below). We focus on collective innovation process, the object of which is a digital infrastructure. Consistent with Markus et al (2006) we assume that the collective good requires heterogeneous resources, which leads to interdependencies. We conceptualize these resources for the collective good as control points, in order to conceptualize the changing degree of interdependency across time. To analyze the collective action we build on Hargrave and Van de Ven (2006) and we look at the collective action processes in terms of *political opportunities*, *construction of networks* and *framing* (Hargrave and Van de Ven). When further examining the construction of networks we also look specifically at *interdependencies* (Heckathorn 1993; Marwell et al 1988, Walter et al 2012; Monge et al 1998) and *governance* aspects (Ostrom, 2000; De Reuver & Bouwman, 2012), as they have been identified to lead to blockages of collective action processes (Section 2.2.1.). Other sources of blockages that we identified in Section 2.2.1 relate to diverging interests and conflicts. For simplicity reasons we will not include these explicitly in our framework but we will discuss these elements when we analyze the interdependencies.

When using the framework we will examine how the network configuration is able (unable) to satisfy the basic control points. In this paper we work with the assumption that there is a set of basic requirements that need to be fulfilled to bring a specific digital innovation on the market. These basic requirements we define basic control points¹. Next we are interested in discontinuities of the collective action processes, how these discontinuities are unlocked, and how the new collective action processes

¹ See Section 3.3 for further explanation how we arrived to the basic control points in the mobile payment domain

look like. In this new configuration of collective action efforts the link to the basic control points is again examined.

A key challenge is to specify the basic control points, as these are context specific and depend on the specific application domain and the goals of the collective action. In the methodology section we describe how we addressed this challenge and how we identified specific control points for the mobile payment domain (the focus of the collective action efforts analyzed in this study).

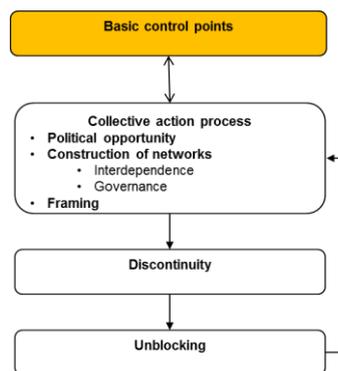


Figure 1. Initial framework

3 Research Approach

3.1 Case selection

In order to understand how collective innovation efforts overcome blockages to bring collective digital innovations to the market we took the mobile payment domain as a case study domain. There are several reasons why this domain is of interest for this study. First of all, the mobile payment domain is a complex domain which requires collective innovation processes of diverse actors such as banks and telecom operators (Dahlberg et al., 2008). Second, the mobile payment required also a shift in controls: some control points which were traditionally covered by banks were now taken over by other players (Ozcan et al 2015). Third, mobile payment digital innovations often struggle to lead to collective action with only few exceptions of successful commercialization (De Reuver et al., 2015). Fourth, we have access to historic data of innovation efforts in the Netherlands (starting with the so-called TRAVIK initiative), which enabled us to trace the developments over time and look for unblocking mechanisms.

As a starting point for our case study we took the TRAVIK project, which was a collective action initiative (in the form of a joint venture) of the three largest Dutch banks and the largest Dutch Telecom operators to cooperate in bringing mobile payment solutions to the Dutch market. Taken in isolation this initiative can be seen as a collective action failure (see De Reuver et al., 2015). However, after dissolving the joint venture, participating parties did bring mobile payment solutions to the market. As such, the case represents the phenomenon of collective action blocking and unblocking, as is the focus in this paper.

3.2 Data collection and analysis

By taking a processual approach we traced the follow-up collective innovation moves of the parties involved. We conducted our study in an interpretative, processual tradition (Markus & Robey, 1988; Pettigrew, 1990, Walsham, 1993) with focus on the actions, decisions and events through which the TRAVIK project unfolded from its inception in 2009 to the formal closure in 2012, and the follow-up events until 2016. The data collection and analysis of our historical case study followed a hermeneutic process (Klein and Myers, 1999). This means that we iterated between the emergent theoretical understanding and the data on which it was based. Table 1 below provides a summary of our data collection efforts spanning the period 2009-2012. For the period 2012-2016, the authors continued to follow the developments that were spin-off from the TRAVIK project, see Section 4.1. Analysis is based on the conceptual lens presented in Section 2 (Figure 1). We used the concepts identified in the framework to characterize each of the collective action initiatives that we traced over time. Control points were operationalized using the expertise of one of the authors who works as a consultant for mobile payment implementations. We paid special attention on identifying unblocking mechanisms and we used the insights from the case to revise the conceptual framework presented in Section 5. The authors discussed

iteratively the findings and adjusted the model to reflect the new insights. In the next section we provide further details on the logic that we followed in identifying the domain-specific control points. Making this logic explicit is important, as in the case we will show that different network configurations emerge surrounding a certain control point (i.e. secure identification and validation), which could be covered by different parties offering different technical solutions (e.g. via the SIM, the Phone or the cloud).

Organization	Position of the interviewee
Bank 1	Manager Consumer Banking
Bank 2- Interviewee 1	Bank Mobile Payment Consultant
Bank 2- Interviewee 2	Technical Business Consultant
Bank 3	Responsible for Cards and eCommerce
Mobile network operator 1	Business Development Manager
Mobile network operator 2	Strategy Manager
Mobile network operator 3	Strategy Consultant
TRAVIK	Sixpack Program Office Project Manager
Currence	Banking Governance Specialist
Card Scheme	General Manager
Payment Service Provider 1	Business Development Manager
Payment Service Provider 2	Mobile Payment Specialist
Merchants Organization	Manager
Mobile Payment Organization 1	Consultant
Mobile payment organization 2	Consultant

Table 1. List of interviewees for the data collection on TRAVIK.

3.3 Domain specific control points for the mobile payment domain

In our conceptual framework we argue that control points can be used to understand how collective action processes evolve over time to bring digital innovations to life. We also propose that these control points are domain specific and would differ per subject domain. A key challenge then is how to specify these domain specific control points, taking mobile payment as our focus of analysis. What we were looking for was a way to identify a set of stable requirements, which may evolve over time as certain characteristics change, which we can use to reason about the dynamics of network evolution as a result of emergence of new technologies or legal requirements. To search for the basic requirements we looked back to the basic requirements related to payment in the traditional physical world then searched for the logic of how these basic requirements got refined and transformed in a digital intermediated world. In this way we aim to trace back and filter complexity and keep the link to the physical world as a reference point to help us identify these basic control points. We used business transactions as an economic exchange as a starting point for identification of control points. In a traditional transaction, the customer (the buyer) receives goods or services for some form of compensation (something else of value in return). In case money is used as a medium of exchange goods or services are exchanged for money. In this situation and in a traditional transaction the buyer holds money, promises to pay and does the actual payment. The seller can see that the buyer possesses money, can request the buyer to pay for the good or service and receives the payment. In this direct exchange in the physical world the buyer is in control over his money, makes the promise to pay and is in control of the actual payment (handing the money to the seller). In an inter-mediated world, banks took over the control over the payments. In this case, the money for the payment are not held directly by the Customer but the bank holds the funds on behalf of the customer. Banks also play a role for facilitating the payment (the communication between the buyer and the seller, as well as the buyer's and seller's banks and the actual settlement). As such banks have control over (1) holding funds on behalf of customer; (2) facilitating payments (communication aspect) once they receive instructions to do so from the customer; and (3) clearing and settlement, doing the actual money transfer from the buyer's to the seller's account. There is legal basis where the banks could hold specific control points (such as holding funds and clearance and settlement), based on licences, which prohibit other actors who do not hold licences to cover certain of these control points.

In an intermediated world when a payment needs to be done via the banks it is essential to identify the seller and the buyer. Next to that as the buyer does not hold the money himself but his bank does on

behalf of him, it is essential to perform identification and validation of the buyer and link the buyer to his funds. There are two other control points that are needed in an intermediated world to link the customer to an account where his money is held, a process called issuing, and a second process of secure identification and validation when transactions take place. This leads us to the two additional control points (4) issuing (i.e. creating a bank account linked to a person) and offer a card or a digitised card to the account), and (5) secure identification and validation. What is also very important is to have some form of (6) technology on the customer's and the merchant's side to facilitate the identification and validation. Examples of technologies are the chip cards on the customer side and the chip readers on the merchant's side. As technology evolves new alternative technologies (e.g. near field communication cards) are able to cover this control point. We consider these as *basic control points* as by covering them in the intermediated digital world we can cover the same basic requirements that are needed for payment in the physical world. The difference is that there are some further complications such as linking buyer to his money which result from the intermediation and digitalization.

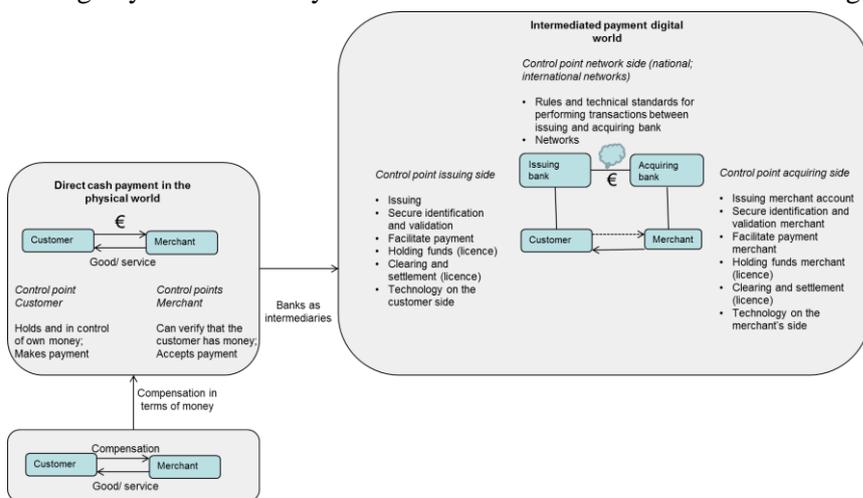


Figure 2. Deriving the basic control points for the payment domain

The control points on the issuing bank on the customer's side and the acquiring bank on the merchant's side can to a large extent be mirrored. What is missing is the link that enables the money to be transferred from the issuing bank to the acquiring bank (something which in a physical world is the process of the customer handing the money to the merchant). This defines the control points of the network providers. These can be national network providers or international network providers such as Master Card and Visa. They hold two important control points, i.e. (a) they define the rules and technical standards for performing transactions between the issuing and acquiring banks; and (b) they provide the network. The figure above captures the logic of how we derived the control points. The right-hand side of the figure lists the basic control points that we identified for inter-mediated digital payment transactions. Looking a step further, with evolution of IT, dynamics can occur in cases when (a) other parties try to take over control over some of the control points held by the banks, or (b) the banks preserve their control points but there are other banks which can cover these points more efficiently. A more radical disruption would be to challenge the use of money as a medium of exchange and use other form of compensation in return (e.g. bit coin and block chain developments). This may initiate a whole new dynamics of how the intermediated exchange can look like in a world that is not yet regulated and defined.

4 Results

4.1 Case background

In 2009, the three telecom operators in the Netherlands, i.e. KPN, T-Mobile, and Vodafone operators and three of the major banks Rabobank, ABN AMRO and ING formed a collaborative institution named TRAVIK, of which they were all shareholders. The aim of TRAVIK was to establish a shared digital infrastructure for authenticating mobile payment users and handling transactions. This can be seen as a collective action initiative where the banks and the telecom operators joined forces in the attempts to bring mobile payment to the market. Telecom operators fulfilled an important role since they controlled the SIM cards, which were, at the time, the only technological option for securely authenticating users when making a payment. The TRAVIK project was dissolved in 2012, without succeeding to reach the common goals. There are many reasons why the initiative did not succeed (see Reuver et al., 2015). One reason is the emergence of technological alternatives such as cloud computing and card emulation, which enabled handset manufacturers to replace the position of telecom operators. After 2012, the TRAVIK network dissolved into two major spin-offs. One of the spin-offs is pursued by Vodafone. Being itself an international company Vodafone joined forces with VISA to pursue its mobile payment ambitions internationally in the so-called 'VISA initiative'. The second spin-off is pursued by the three banks who conducted a local pilot with telecom operator KPN, the so called 'Leiden initiative'. The Leiden initiative was led by the three banks and the telecom company KPN joined as a sub-contractor rather than as an equal partner. From its very beginning, the ambition of the Leiden initiative was to jointly learn about mobile payment, although each bank would separately commercialize the technology after the project is completed. After the Leiden initiative was completed, each of the banks did set-up their own network of partners to pursue mobile payments. In these last network configurations the phone providers (such as Appel and Samsung) and the provider of operating systems (Android) became the new partners.

4.2 Summary of the findings

Table 2 below summarizes the findings from the analysis. For the analysis of the network we use the multi-level network visualization (Rukanova et al., 2009). The first column of Table 2 contains the concepts from our initial conceptual framework (See also Figure 1, Section 2). The remaining columns are used to capture the TRAVIK and the spin-off collective action efforts. The table describes the *basic control points* covered, the *political opportunities*, the *construction of networks* (looking at interdependencies as well as governance), *framing*, the *discontinuity* of the collective action efforts, as well as the *unblocking mechanisms*. Due to space limitations we will not go into further explanation of the findings in the table but we will discuss the main findings in the discussion section.

	Collective action 1 (TRAVIK t1a)	Collective action 1 (TRAVIK t1b)	Collective action t2a (Leiden Initiative)	Collective action Rabobank partnering with Samsung (t3a, with focus on Rabobank)	Collective action t2b
Basic control points (CP)	Dutch Banks hold most of the control points initially held by the bank but Banks give up control related to the CP secure identification and validation <ul style="list-style-type: none"> Control point taken over by Telecoms (strong position) <ul style="list-style-type: none"> Technology SIM-based solution (no substitutes) 	Dutch Banks hold most of the control points initially held by the bank but Banks give up control related to the CP secure identification and validation <ul style="list-style-type: none"> Control point taken over by Telecoms (position weakened) <ul style="list-style-type: none"> MNO- SIM-based solution (there are substitutes) Technology phone providers- phone-based solution Operation system providers- cloud-based solution 	Dutch Banks hold most of the control points initially held by the bank but Banks give up control related to the CP secure identification and validation <ul style="list-style-type: none"> Control point taken over by Telecoms (position weakened) <ul style="list-style-type: none"> Technology of MNO- SIM-based solution (there are substitutes) Technology phone providers- phone-based solution Technology Operation system providers- cloud-based solution 	Rabobank partnering with Samsung (3a- Rabobank) Banks give up control related to the CP secure identification and validation <ul style="list-style-type: none"> Control point taken over by phone provider <ul style="list-style-type: none"> Technology phone providers- phone-based solution Control point "Facilitate payment" initially held by the banks threatened (due to payment directive) The position of the banks as intermediaries in the exchange ((including all the control points) threatened (bit coin and block chain))	Vodafone holds the control point related to identification and validation but misses the other control points that were held by the Dutch banks in TRAVIK. It needs partners to cover the remaining control points <ul style="list-style-type: none"> Vodafone as part of Vodafone group has international ambitions Vodafone joins VISA in the VISA initiative (VISA covers the other CPs initially covered by the Dutch banks but VISA does this internationally)
Political opportunity	-	• Cloud and phone-based solutions	• Cloud and phone-based solutions	• Payment directive • Bitcoins and Block chain	• Cloud and phone-based solutions • The Visa initiative
Construction of networks²					
	Interdependences: <ul style="list-style-type: none"> Banks- Telecoms: High level interdependence (resource heterogeneity; lack of alternatives) Banks- Interest heterogeneity- high potential for conflicts Telecoms - Interest heterogeneity- high potential for conflicts Governance: <ul style="list-style-type: none"> Joint-venture (for covering control point secure linking SE to the account) 	Interdependences: <ul style="list-style-type: none"> Banks- Telecoms: interdependence weakens (resource heterogeneity; cloud and phone based solutions as alternatives) Banks- Interest heterogeneity- high potential for conflicts Telecoms - Interest heterogeneity- high potential for conflicts Governance: <ul style="list-style-type: none"> Joint venture efforts discontinued 	Interdependences: <ul style="list-style-type: none"> Banks- Telecoms: interdependence weakens (resource heterogeneity; cloud and phone based solutions as alternatives) Banks- Interest heterogeneity- high potential for conflicts Telecoms - Interest heterogeneity eliminated- only one Telecoms left Governance: <ul style="list-style-type: none"> Banks in the lead, Telecoms involved via sub-contracting (weaker position) 	Interdependences: <ul style="list-style-type: none"> Banks- Telecoms: no interdependence (resource heterogeneity; cloud and phone based solutions as alternatives) Banks- Interest heterogeneity eliminated; only one bank MNOs- Interest heterogeneity eliminated- no MNOs in the network Bank- Phone company (Samsung): strong interdependence due to partnership (resource heterogeneity, but alternatives available) Governance: <ul style="list-style-type: none"> Partnership 	Interdependences: <ul style="list-style-type: none"> Banks- Telecoms (Vodafone- Visa)- interdependence; resource heterogeneity preserved; the basic control points covered and move to an international level; Banks- Interdependence with the Dutch banks initially in TRAVIK eliminated Telecoms - Interdependence with other telecom operators participating in TRAVIK not participating in the VISA initiative) Governance
Framing	- To establish a joint platform to serve as a Trusted Service Manager (TSM) linked to the control point Identification and Verification - National level initiative	- Initiative stopped: No longer an ambition to establish a common platform - National level initiative	- Jointly learning about the possibilities of mobile payment - National level initiative	- Jointly learning about the possibilities of mobile payment - National level initiative	- Reframing the objectives from joint platform to joint launching of mobile payment solutions - International level initiative
Discontinuity of CA	n.a.	Initiative stopped	Discontinuity was agreed-upon upfront that the project would end once the parties learn more about mobile payment possibilities	Initiative still on-going	On-going
Unlocking strategy	n.a.	See next column	Transition TRAVIK→ Leiden initiative <ul style="list-style-type: none"> Reframing objectives from joint platform to joint learning initiative Reconfiguration of network through <ul style="list-style-type: none"> Exclusion: from involving all the three Telecoms to a network with only one Telecoms; keeping the resource heterogeneity but reducing the interest heterogeneity of in the Telecoms Change governance structure <ul style="list-style-type: none"> From joint-venture to sub-contracting; One of the partner types (Banks) takes the leadership. 	Transition Leiden Initiative→ Samsung partnership <ul style="list-style-type: none"> Reframing the objectives from joint learning to joint launching of mobile payment solutions Reconfiguration of the network <ul style="list-style-type: none"> Substitution (Samsung:: same control point, different technical solution; keeps resource heterogeneity Resizing- exclusion of other banks, reduces the interest heterogeneity of the banks. Change in governance structure <ul style="list-style-type: none"> Sub-contraction to partnership 	Transition TRAVIK→ Vodafone as part of the VISA initiative <ul style="list-style-type: none"> Reframing in terms of level of ambition (from national to international) Reconfiguring the network to cover missing control points. Moving from involving banks with national ambitions to involving financial institutions with international ambition/ coverage. (Reconstruction through substitution of actors (same control point/ different levels)

Table 2. From TRAVIK through the Leiden Initiative towards the individual initiatives of the banks

² These network diagrams are useful for showing the high-level moves but due to space limitation we are not able to provide fully readable images in the overview tables. The diagrams can be read in an electronic version.

5 Discussion

Our analysis reveals the TRAVIK collective action as one stepping stone in the collective innovation processes that ultimately resulted in mobile payments solutions available today on the market. By applying our initial conceptual framework and based on the case findings we developed our revised *Framework of control point driven collective action process for digital innovation* (See Figure 3).

Looking at the TRAVIK case in isolation we can see it as a failure. Earlier research explains in detail why the initiative seen in isolation was put on halt (de Reuver et al., 2015). Looking at retrospective we can ask the question why did the parties waste so much time and effort to collaborate when the initiative stopped at the end without the parties being able to bring together the mobile payment on the market. Why weren't they smart enough to see the conflicts and to know in advance that this initiatives would not work and look for other winning configurations from the start. One of the reasons is that collective innovations take place in an environment that is very dynamic, and where among others changes in technology and regulations can change the interdependencies. In other circumstances, for examples if cloud computing did not appear as an alternative, the interdependencies among the parties in the TRAVIK network could have remained strong, and perhaps the willingness of parties to collaborate would have been bigger and they would have sought possibilities to overcome the conflicts. We will never know.

What we do know, however, is that the TRAVIK initiative was stopped but over time collective innovation processes proceeded. Most of the parties that were involved in the TRAVIK initiative are now active in the mobile payment market. By looking at collective innovation as a process, the TRAVIK initiative is one collective action initiative, which was succeeded by a number of other collective innovation efforts. It was one of a number of steps in this process, where parties gained knowledge about the new innovation domain (mobile payment), they gained knowledge about the network and through learning they found ultimately win-win configurations to bring mobile payment innovations on the market.

In collective action literature it has been also discussed that as collective action initiatives develop, they can link or branch out and interact with other collective action initiatives or social movements, and as such they become part of larger collective action efforts (Blumer, 1969; Kling & Iacono, 1998). In a similar way, we see that from TRAVIK, other collective action initiatives branched-out and parties looked for other configurations and initiatives nationally (Leiden initiative) and internationally (Visa initiative). It is these series of collective action efforts that brought the mobile payment solutions of the parties involved to the market. We argue that in order to understand collective innovations it is essential to look at collective innovation initiatives as TRAVIK in a process and wider perspective of succession with follow-up collective actions and involvement. In this wider perspective they are no longer a failure, but a key in revealing how digital innovations are shaped and brought to implementation.

5.1 Unblocking mechanisms

Based on our case analysis we found three types of unblocking mechanisms for collective action: network reconfiguration, re-framing and change of governance model.

The findings related to the three types of unblocking mechanisms are summarized in Table 3 below. Regarding network reconfiguration we found:

Unblocking mechanisms	Example from the case
(Re) configuration of the network	
(Re) configuration through <i>reduction of number of participants holding the same control point</i> <ul style="list-style-type: none"> Exclusion by reducing the number of participants holding the same control point 	The Leiden initiative, only one of the telecom companies remained
(Re) configuration through <i>substitution</i> <ul style="list-style-type: none"> <i>Alternative means to cover a control point:</i> To replace actors in the network who cover specific con- 	<ul style="list-style-type: none"> <i>Alternative means:</i> The individual bank initiatives where they substitute the telecom operators with phone providers

<p>ontrol points with other actors who can cover the same control point but with alternative means</p> <ul style="list-style-type: none"> • <i>Alternative level:</i> To replace an actor covering a specific control point with an actor from another level who can cover the same control point. 	<p>and operating system providers</p> <ul style="list-style-type: none"> • <i>Alternative levels:</i> Vodafone changed from partnering with Banks operating at national level to Visa, a global actor.
(Re) framing	
<p>(Re) Framing of the collective action <i>objectives</i></p> <ul style="list-style-type: none"> • Joint platform • Joint learning • Joint product <p>(Re) Framing of the collective action <i>ambitions (levels)</i></p>	<ul style="list-style-type: none"> • TRAVIK • Leiden initiative • Mobile payment solutions offered by the banks <ul style="list-style-type: none"> • Visa initiative (move of framing from a national to international ambition)
Change in governance	
<p>Alternative governance models (limited to what identified in the case)</p> <ul style="list-style-type: none"> • Joint-venture • Sub-contracting • Partnership 	<ul style="list-style-type: none"> • TRAVIK • Leiden Initiative • Partnership Rabobank and Samsung

Table 3. Overview of unblocking mechanisms identified in the case

Reconfiguration through exclusion of participants holding the same control point

In the Leiden initiative, the banks took the lead and reduced the number of telecom operators from three to one. In that respect, they reduced the complexity of the network by reducing the number of participants covering the control point related to identification and validation. There was still an issue of network complexity among the banks, as all the banks covered the same control points. In the third step the reconfiguration through the reduction of number of participants holding the same control point further applied to the banks. In the final collective action network configurations which was about bringing a commercial product to the market there was only one bank involved. Thus, the competing banks benefited from joint learning in the collective action efforts of the Leiden initiative but for bringing the actual product to the market they engaged in follow-up collective action efforts excluding rivals holding the same control points.

Reconfiguration through substitution by actors offering alternative means to cover a control point

Substitution by actors covering the same control point with other means is another strategy for reconfiguring the network, which was used in the process of bringing mobile payment solutions to the market. In the individual initiatives of the banks, following the Leiden initiative the telecom operators that were holding the control point related to identification and authentication through a SIM-based solution were substituted by actors who could cover the same control point but via other means (via the phone or via the cloud).

Reconfiguration through substitution by actors covering a control point at a different level (geographical coverage)

A third reconfiguration mechanism that we identified was by substituting actors holding a control point and operating at one level (e.g. national) by actors operation at another level (international). This can be seen in a Vodafone joining the VISA initiative. When TRAVIK stopped Vodafone alone was not able to launch mobile payment solutions, as it did not hold the control points that were initially held by the Dutch Banks. Aligned with its international operation, Vodafone joined collective action efforts where the control points that were covered initially by the Dutch banks (national level) were now covered by a global actor (Visa).

- Regarding Re- Framing

We identify unblocking mechanisms that relate to framing. Framing is of key element when analysing collective action initiatives (Hargrave and van de Ven, 2006; Constantinides, 2014, Rukanova et. al, 2008, van Stijn et al., 2009). In our analysis we see that framing is an essential element in the unblocking of collective action initiatives. More specifically we see two re-framing mechanisms, namely one related to *reframing of objectives* and one related to *reframing of the level of the collective action ambition*. Related to reframing of objectives we saw a shift of objectives from offering a joint platform

(TRAVIK), to joint learning (Leiden initiative), to offering a joint product (payment solutions offered by the individual banks). Regarding the *Reframing of the level of ambition*, as we saw in the case, Vodafone decided to fill-in the missing control points originally covered by the Banks operating in the Netherlands with a player operating internationally and reframed the collective action ambitions moving from the national to the international level.

- Regarding change of governance

The third type of unblocking mechanisms that we observed related to governance. Compared to TRAVIK, we identified that the subsequent collective action initiatives also changed the governance model and we saw that joint-venture, sub-contracting and partnership were used as governance models.

5.2 Revised Framework for control point driven collective action for digital innovation

Figure 3 below presents our revised Framework of control point driven collective action process for digital innovations. This framework is based on our initial conceptual framework presented in Section 2.4 (see Figure 1) which we further developed based on the findings from the case.

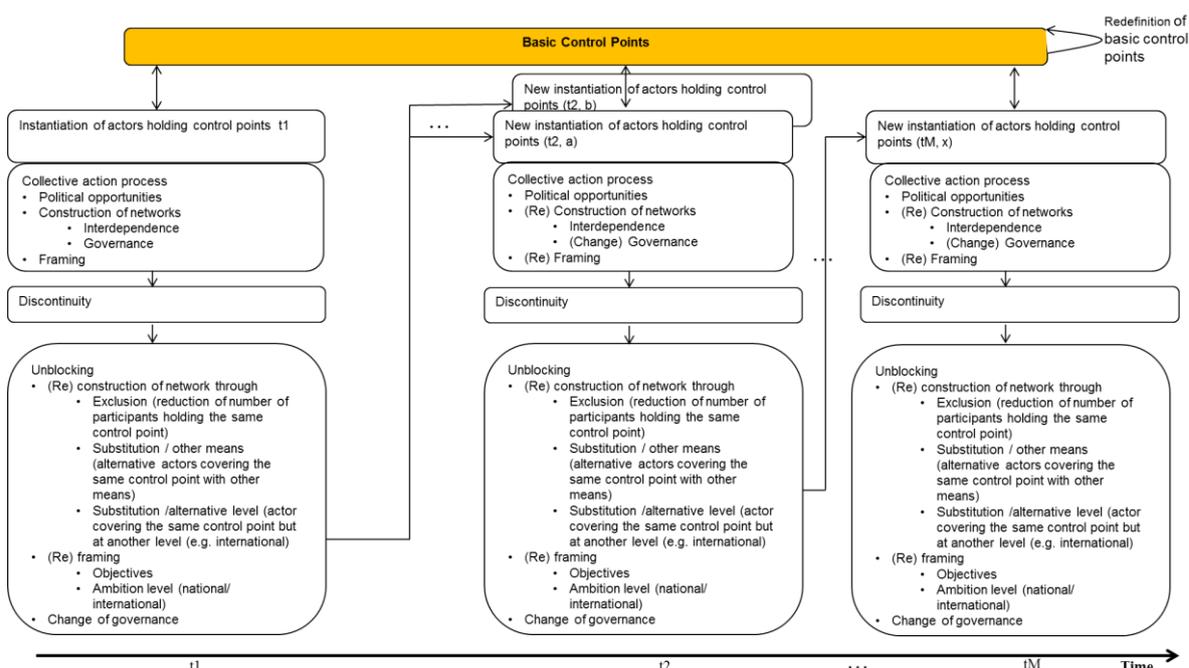


Figure 3. Framework of control point driven collective action process for digital innovation

The initial conceptual framework (Figure 1) was expanded as follows. First, we further extended the framework to explicitly include the three types of unblocking mechanisms that we identified (see also Table 3). Second, we explicitly included a time dimension to be able to trace follow-up collective action configurations. There are more than one arrows in the transition from t1 to t2 to indicate that unblocking can lead to more than one follow-up collective action initiatives which represent new configuration of actors holding the control points (e.g. the Visa and the Leiden initiatives). We added also further tM in the figure to show that the sequence of collective action efforts, followed by blockages and unblocking can repeat numerous times (e.g. the RaboBank and Samsung partnership that brought the mobile solution to the market was preceded by the Leiden initiative and TRAVIK. In the Visa initiative, Vodafone was able to bring the mobile solutions to the market right after TRAVIK). In the model we included the possibility to redefine the basic control points over time. This is based on the analysis that we conducted when arriving at the basic control points in the mobile payment domain.

This is to capture possibilities when changes due to technological innovation or other circumstances can lead to adding new control points or redefining the existing ones (as was the case when moving from the traditional payment transactions to the intermediated exchanges, see Section 3.3).

6 Conclusions

In this paper, by using the collective action perspective in combination with control points and based on insights from the mobile payment domain we developed a conceptual framework that brings insights into mechanisms that can help to unblock collective action efforts and move collective digital innovation towards implementation. The framework that we developed helps us to understand the processes and moves that the parties made to bring digital innovations to the market and potentially it can be used to identify other possible moves and potential new network configurations. With respect to research, this paper can be seen as a contribution to the emerging body of research in the digital infrastructure literature which uses collective action perspective to understand and explain complexities related to digital infrastructures.

Regarding the implications of our findings for practice: Collective action efforts for digital innovations are likely to happen in a dynamic environment, where changes in the environmental conditions or internal dynamics of the initial collective action configuration can bring the initiative to a standstill. Based on insights from the mobile payment domain we argue that parties can look for alternatives by re-framing of the objectives, re-configuration of the network and changing the governance. In such way parties can unblock this standstill and search for new collective action configurations. Control points can be useful instrument for further identifying possible new network configurations and potential threats to current configurations. In this respect, the framework that we provide in this paper can be used as an analytical tool for strategists to examine alternative collective routes they could follow in bringing collective innovations towards implementation. Collective digital innovations can be witnessed in numerous domains and often span over a long periods of time. Learning how to manage the unblocking processes potentially can make these processes more efficient and effective, allowing for faster implementation and upscaling.

A limitation of our study is that it is based on one domain, i.e. mobile payment and reflects predominantly the experience from The Netherlands. Further research can proceed in a number of directions as follows. First, the control point collective action framework developed in this study can be applied to a number of other domains where digital infrastructure innovations are taking place, such as energy (e.g. the smart grid initiatives), healthcare (e.g. the electronic patient record initiatives), as well as international trade (e.g. digital trade infrastructure initiatives for supply chain visibility). Such studies will help to further test, validate and refine the control point collective action framework, allowing for a much richer understanding of the innovation processes and unblocking mechanisms. Second, further research can also focus on eliciting the basic control points in different domains. This would allow to derive guidelines and more structured recommendations how to identify the basic control points in new domains. Third, research can also focus on whether and how the collective action control point framework can be used proactively. For example we now see the emergence of block chain as a new technology which can potentially disrupt existing practices in the financial, but also other domains. Interesting questions could be how current network configurations covering the basic control points could be disturbed by this new technology and what are potential new players that can take over some of the control points.

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