How Organizational Path Constitution Prepares Digital Infrastructure Innovation: A Case Study of Integrated Care

Full Paper

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Abstract

We investigate the organizational processes that predate digital infrastructure innovation in health care. These processes are important because the diffusion of digital infrastructures is problematic in many health care settings around the world. However, our study allows decision makers to understand how organizations can become forerunners in the area of digital infrastructures even in rigid institutional environments where powerful barriers to the diffusion are in place. In order to make these points, we combine theories on organizational path constitution and digital infrastructure innovation and apply them to a case study of a health care provider establishing novel processes in the area of “chronic obstructive pulmonary disease” (COPD) care.

Keywords

Digital Infrastructure Innovation; Organizational Path Constitution; Integrated Care

1. Introduction

“Digitalization could significantly strengthen the efficiency and quality of German health care services” – OECD 2015

Dave, a German patient, faces a difficult choice. He used to be physically active before he was diagnosed with COPD, a chronic disease that makes it difficult to breathe. Hence, Dave needs permanent mechanical ventilation while having to stay in bed. This means that Dave has to be hospitalized even though he would like to stay at home. In this context, digital infrastructures play a key role, especially for elderly patients (cf. Bowles et al. 2015). Their usage enables data integration across hospital and home care settings. Moreover, they also enable integrating various e-health services and care practices. For example, Dave could stay at home while respiratory physicians, general practitioners, and nursing staff exchange treatment-related information in real time (cf. Emme et al. 2014).

While the case of Dave is fictional, it indicates some challenges in contemporary health care. Given increases in life expectancy, the spread of chronic diseases and technological change (WHO 2015), health care faces challenges and opportunities. Challenges relate to the adaptation of health care delivery to the demands of the chronically ill. Services for the latter would ideally draw on neat information exchanges between medical professionals since chronically ill patients usually have to consult with many different medical professionals. Therefore, health IT in general and digital infrastructures in particular provide major opportunities to support integrated care (Grossmann et al. 2011; Stroetmann et al. 2013; Wessel and Gersch 2015). By integrated care, we refer to a patient-centric care model (an organizational form) that enables the seamless flow of information among different healthcare professionals and sectors (Kodner and Spreewenberg 2002). What is puzzling in Germany—and to some extent in other countries—is the persistence of a traditional care model with separated primary (hospital), secondary (ambulant), and home care with little integration and cooperation. Despite the increasing need for integrated care, Germany is a particularly problematic case since implementation rates of integrated care fall back behind other European
countries (Lluch and Abadie 2013). The sectorial separation leads to various systems in-use, which in turn, reinforce difficulties to integrate them (cf. Wessel and Gersch 2015).

Consequently, several attempts have been made to establish a technical backbone for treatment processes, which integrate different sectors more seamlessly. The largest chunk of these attempts comprises policy interventions in the forms of laws that have set certain incentives for the implementation of these infrastructures (eHealth Strategies 2011). However, the results are generally mixed and information systems (IS) researchers have documented that particularly the “top-down” approach was problematic in Germany (Klöcker et al. 2015). Thus, a more practically-oriented approach could lie in better understanding how individual organizations can contribute to digital infrastructure innovation in a more bottom up manner (see Constantinides and Barrett 2015). Instead of looking at digital infrastructure innovation from a macro-level as in many policy-interventions, such an approach would take seriously how organizations can address and overcome the challenges inflicted upon them by sectorial separation.

This paper is in the spirit of this latter view. In more detail, we attend to the earliest stages of digital infrastructure innovation. We explore several processes that enable an organization to innovate in the area of digital infrastructures in the context of COPD care. While these processes are embedded in a larger institutional framework of law and regulation, we do find that an understanding of these processes is potentially valuable to the reorganization of health care given that these processes disclose how innovation is enabled through interventions on the organizational level—and not only on the policy level. Thus, we believe that our work is more closely aligned with the reality of decision makers within organizations.

We can address this practical relevance because we engage with extant theory in potentially novel ways. In more detail, we link the more recent literature on path constitution (Sydow et al. 2012; Singh et al. 2015) to the literature on digital infrastructure innovation (Henfridsson and Bygstad 2013; Yoo et al. 2010). These are indeed complements because the former literature explores organizational processes without attending to the scaling of an infrastructure whereas the latter powerfully explores the scaling but does not fully take into account the organizational processes that enable organizations to become digital infrastructure innovators in the first place. Broadly speaking, by organizational path constitution, we refer to attempts by mindful, collective actors to break away from established paths and to create new, innovative organizational forms and respective digital infrastructures. By digital infrastructure in integrated care, we refer to the sociotechnical systems (i.e., applications, services, and IT capabilities) and processes that bridge the gap between hospitals, general practitioners, and specialists. The term also relates the use of mobile IT and other digital technologies that can help to achieve better integration for and between patients and professionals. Building on the notion of path constitution in digital infrastructure innovation, we ask:

**How does organizational path constitution prepare digital infrastructure innovation in integrated care?**

Against this background, we analyze data from a fairly successful model of integrated care in Germany. We use this case to investigate the processes that prepare digital infrastructure innovation on an organizational level. Based thereupon, we reason how a holistic view of digital infrastructure innovation as path creation could inform efforts towards a stronger diffusion of integrated care on a larger scale. To arrive at these contributions, section 2 presents the conceptual background. Section 3 introduces the methods of this study. Results from the case are presented in section 4. Section 5 summarizes the findings and discusses implications and future directions.

**2. How Path Constitution Prepares Digital Infrastructure Innovation**

*Digital infrastructures and digital infrastructure innovation.* Digital infrastructures are large scale sociotechnical systems that share many characteristics with other infrastructures such as the transportation systems or telecommunication networks (Hanseth and Lyytinen 2010). Healthcare is generally a good example for the importance of digital infrastructure provided that the need to share data among many different medical professionals, care providers, insurance companies, patients and others is constantly increasing (Aanestad and Jensen 2011; Hanseth and Aanestad 2003).

However, the literature on digital infrastructures is limited in explaining how individual organizations can become innovators in that area. This is because most studies on digital infrastructures focus on their large-scale rollout. Hanseth and Bygstad (2015, p. 4) remark that in the health care sector digital infrastructures “may encompass several patient record (EPR) systems, hundreds of medical units and tens of thousands of users.” Consequently, the literature is rich on advice for the “startup problem”—the problem of
bootstrapping (Hanseth and Aanestad 2003; Hanseth and Lytinen 2010; Aanestad and Jensen 2011) and scaling up (Monteiro 1998; Braa et al. 2007; Henfridsson and Bygstad 2013; Aanestad et al. 2014) a new infrastructure with large numbers of users, acknowledging the importance of designing for initial usefulness (Hanseth and Lytinen 2010), using modular implementation strategies (Aanestad and Jensen 2011), and building on and expanding installed bases (Hanseth and Lytinen 2010). Yet, since few studies have explored the level of an individual organization, they have largely not touched on how individual organizations can prepare themselves to become innovators in this area.

**Digital infrastructure innovation.** While organizational processes are key to digital infrastructure innovation, we know relatively little about them. In particular, digital infrastructures “do not emerge from scratch” (Ciborra 2000) and new components and technologies emerge in a distributed way and in many different levels of a digital infrastructure: of, in, and on it (Grisot et al. 2014). At the heart of this “innovation mechanism” is the insufficiency of an existing infrastructure. In consequence, new services emerge that are recombined with existing ones, all of which meld into a new version of the infrastructure (Henfridsson and Bygstad 2013). This happens by constant tinkering on different levels (Ciborra 2004). It is achieved by individuals and organizations performing different processes such as improvisation (Ciborra 2004), bricolage (Ciborra 2004), or hacking (Rolland et al. 2015). What is important for managers is how an organization can prepare to partake in such processes to become an innovator in the area of digital infrastructures. To address this question, we link the literature on digital infrastructures to the concept of organizational path constitution (Sydow et al. 2012; Singh et al. 2015).

**How path constitution pre dates digital infrastructure innovation.** Path constitution is a promising perspective to better understand innovation in digital infrastructures from an organizational viewpoint. This lens has been previously used in studies on the role of collaboration networks in the emergence of new technological standards, e.g. in semiconductor manufacturing (Sydow et al. 2012) and in social studies of technological evolution paths (Meyer and Schubert 2007). It has also been salient in studies of distributed and embedded agency underlying the emergence of new technological markets such as those for wind turbines in the U.S. and Denmark (Garud and Karknoe 2003). Closest to our study, it was used to trace the establishment of a telemedicine network in Georgia, U.S. (Singh et al. 2015). It balances more mechanistic arguments (“path dependence”), pointing to “lock-in” from self-reinforcement that emerges, potentially contrary to managerial intent (Wenzel et al. 2015), and the agentic view (“path creation”), emphasizing individual and collective agency in the creation of new technological, institutional, or organizational paths (Garud and Karknoe 2001). Integrating both views in a model that is attentive to “multi-actor constellations on multiple levels”, path constitution “always implies a certain degree of path dependence in the sense that path processes, even if they are intentionally created, show a kind of irreversibility, momentum, and possibly lock-in” (Sydow et al. 2012, p. 155). As digital infrastructure innovation also constitutes a potentially self-reinforcing process that is shaped by multiple actors (e.g. care providers, vendors, and medical professions) on multiple levels, it is promising to consider digital infrastructure innovation from a path constitution perspective. However, both literatures have not yet been linked. Thus, our paper attempts to exploit these synergies.

**3. Methods**

**Case context.** We analyzed the integrated care provider Gas Co (synonym). A case method is appropriate since it enables exploring the phenomenon in its real-world context, which potentially allows for theoretical insights and abstractions (Yin 2013). The case company is a large multinational that is known as a world leader in the area of industry gases. Since 2005, Gas Co. is using the brand “Arrive” in Germany and worldwide for a care model to treat long-term ventilated patients. The care model includes care centers that can be seen as bridges between intensive care units and home care. To enable patients to “arrive at home”, Gas Co. has supported the creation of an integrated care model—which we anonymize as Breathe@home. The case was selected for three reasons. First, integrated care in Germany is still a niche (Luch and Abadie 2013). The case is one of few comparatively successful examples of creating an integrated care model and can thus be instructive for drawing conclusions in order to answer our research question. Second, the successful establishment of an integrated care model requires building a digital infrastructure for enabling coordination among multiple actors and sectors. This makes the case particularly relevant for our question. Third, we had comprehensive access to the case in both real-time as well as retrospectively, illustrating both the emergence and the preconditions for path constitution.
**Data collection.** We collected longitudinal, qualitative data from interviews, observations, and archival material. The empirical data base resulted from two round of data collection in 2010-2012 and 2013-2016. Data comprised 29 interviews with managers, nurses, IT project team members, among others. Interviews were tape-recorded and transcribed. In addition, 120 hours of participant observation were carried from which we extracted 1,010 pages of text. In addition, we collected about 3,740 pages of secondary documents (presentations, press articles, and company reports). These documents assisted in triangulating, refining, and challenging our findings.

**Data analysis.** Data analysis was theory-guided and followed a qualitative strategy (Miles and Huberman 1994). We analyzed the data in multiple steps. As we focused on organizational path constitution in technical innovation, we drew on the framework by Singh et al. (2015). The framework is useful because it features a view of innovation as a sociotechnical process in which technical and organizational elements interact (Wenzel et al. 2015). It builds on a process perspective (Langley 1999) and figures centrally a view of innovation and change as episodes of a larger process. In particular, the framework forced us to identify core episodes of organizational path constitution and respective innovation triggers. Furthermore, we followed the advice to code the data according to response modes (emergent, deliberate, and mixed) as well as path constitution impacts (reinforcing or transforming). Furthermore, we built on Singh et al.’s (2015) suggestion to identify the status of the innovation path in core episodes by coding the data according to innovation core, scope, and innovation resources. In a final step, we expanded the scope of the analysis by drawing on Sydow et al.’s (2012) path constitution analysis methodology. Their framework added a focus on “multiple actor constellations on multiple levels of analysis” (p. 155) as necessary to go beyond the scope of a single organization and to capture the interorganizational process of digital infrastructure innovation.

4. Interorganizational Path Constitution in an Integrated Care Scenario

The following sections present the results of the case analysis. First, we describe the four core episodes of path constitution from a perspective of Gas Co. These episodes span the time from market entry in 2005 till the cooperative execution of integrated care in 2016. Afterwards we focus on the last episode and discuss the integration of multiple organizational paths into one interorganizational path. When portraying the integrated care model (Breathe@home) and the underlying infrastructure, we focus on Gas Co.’s collaboration with a leading university hospital in a metropolitan area.

4.1 Gas Co.’s Path Toward Integrated Care

Table 1 shows four core episodes of Gas Co. toward integrated care. For each episode, we identified internal as well as external innovation triggers characterizing the respective episode. Whereas internal triggers are initiated from within the organization, external triggers refer to developments and events outside the organization (Singh et al. 2015). Furthermore, the table shows the response mode of Gas Co. to these innovation triggers and the constitution impact on the innovation path. In terms of response mode, we distinguished deliberate, emergent, and mixed responses (Singh et al. 2015). The constitution impact on the innovation path may be transforming, triggering the turning away from a particular path, or reinforcing, strengthening a path (Singh et al. 2015). The following sections detail these episodes.

**Episode 1: Market Entry in the Ambulant Care of Long-Term Ventilated Patients**

Gas Co. entered the market for long-term ventilation by acquiring a specialized respiration therapy vendor in 2005. The conditions favoring this step were general demographic dynamics on a population level and a government act to strengthen integrated care. These developments made it appear reasonable to view healthcare as a profitable future market, as illustrated by the following quote:

“It’s decisive is that this is a future trend that we (a) want to shape and (b) want to master. And you can only learn it if you participate and we are strongly convinced that ventilation, particularly ambulant ventilation and telemedicine is an enormous future trend.” (Interview #9)

Gas Co. brought in first experiences and ideas for medical care from its practice of medical gas treatments for long-term ventilated patients. The new capability was built around that knowledge. Yet, the market entry also brought disadvantages. Particularly challenging for Gas Co. was building structures for managing care and also establishing care practices. There were two main reasons. First, Gas Co. lacked knowledge on the actual organizational and regulatory processes to manage care. Second, Gas Co. was underestimating the
pressure from low-cost competitors dominating the market for long-term ventilated patients. This made it challenging for Gas Co. to maintain a quality brand while staying competitive.

<table>
<thead>
<tr>
<th>Core episodes</th>
<th>Innovation trigger</th>
<th>Response mode</th>
<th>Constitution impact</th>
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| 1. Market entry and competency building in ambulant care (2005 onwards) | • 2004 government act strengthens integrated care (external)  
• Existing competencies regarding respiration therapy from offerings in medical gas division (internal)  
• Acquiring competencies in home care (external)  
• Gas Co.’s management views care as a future business opportunity (internal) | Mixed         | Reinforcing         |
| 2. Establishing “Arrive” as a quality brand (2007 onwards) | • Quality as a corporate principle (internal)  
• Fear of reputational damages (internal)  
• Management in search for differentiation (internal) | Deliberate    | Reinforcing         |
| 3. National and international expansion with telemedicine (2009 onwards) | • Vision to set a standard and scale it nationally and internationally (internal)  
• Study suggests continuous increase in the number of long-term ventilated patients (estimation: 2,500 patients increase per year) (external)  
• Study suggests that ambulant ventilation becomes an attractive business model (about 600 ambulant intensive care providers in Germany) (external)  
• Strong low-cost competition suggests a long-term reduction of insurances’ willingness-to-pay (external)  
• Government act (§ 140 b SGB V) extends number of potential partners for integrated care (external)  
• First attempts to cooperate and planning for “telehealth” model from 2011 (internal) | Deliberate    | Reinforcing         |
| 4. First collaboration in an integrated care scenario (2013 onwards) | • Managers expect positive reputation effects (internal)  
• Gas Co.’s management views telemedicine in ambulant ventilation is as a future trend (internal)  
• Government act (“GKV-Versorgungsstrukturgesetz”) to secure national-wide health care services, esp. targeting rural areas and telehealth in 2012 (external)  
• New government agrees to strengthen ambulant sector (“supply gaps in the transfer from stationary to the ambulant sector should be closed”) in 2013 (external)  
• Kick-off for industry research project “Breathe@home” in 2013 (internal) | Mixed         | Reinforcing         |

Table 1. Core episodes and triggers for Gas Co.’s innovation path

Episode 2: Establishing “Arrive” as a Quality Brand

To escape the aggressive competition, Gas Co. searched for a “blue ocean” that enabled differentiation from the market. The solution was an innovative care concept bridging the gap between intensive care and returning home. We anonymize the concept as Arrive as it aims at enabling ventilated patients to arrive home that have not been able to do so previously. Professionalization was one main pillar of the concept by which Gas Co. aimed at providing constant care quality on highest levels. This was achieved by establishing process standards and certifying the organization as well as qualification and training programs in line with parallel emerging inter-sectoral medical guidelines. The strong emphasis of quality standards was driven by Gas Co.’s concern that reputational damages with Arrive could spill back and affect the entire group:

“Imagine if my company would damage the name of Gas Co. because we offer inferior or deficient quality. It would not be ‘Arrive’ in spotlight then but Gas Co. And this may have massive negative implications. That’s why a segment of Gas Co. could only work with highest quality standards.” (Interview #3)
Episode 3: National and International Expansion with Telemedicine

In 2008, Gas Co. participated in a research project to evaluate the economic dimension of Arrive as a home care concept and to delve into the potentials of digital technologies such as ambient assistant living or telemedicine. Moreover, the company was actively promoting collaborative research projects together with universities, hospitals, and scientists in the new area of applying medical gases (e.g. by research funds or fellowships).

In 2010, Gas Co. began to scale the concept of Arrive care centers nationally (in 2015: 8) and internationally (in 2015: 52). This was favored by several conditions such as the continuous increase of long-term ventilated patients and the growth of ambulant care into a sustainable business model. Furthermore, internal factors such as the internal logic of Gas Co. as a profit-oriented company made it reasonable to strive for extension and scaling of the Arrive concept. Importantly, Gas Co. aimed for high quality by standardizing workflows, qualifications, and training programs. In less restrictive non-German contexts, it also integrated new services into the Arrive concept, for instance, weaning (to wean patients from mechanical ventilation) and telemedicine. Arrive was scaled up to 60 centers worldwide in 2015.

Episode 4: First Cooperation in an Integrated Care Scenario

In 2013, a research project (Breathe@home) was launched that brought together Gas Co. and other partners to define a standard workflow in integrated care for long-term ventilated patients by drawing on advanced telemedicine and e-health applications. Two main reasons triggered Gas Co.’s commitment to the project. First, the project was consistent with Gas Co.’s belief of telemedicine as a future trend in ambulant ventilation. Second, Gas Co. was expecting reputational gains and the project to strengthen its role as a leader in integrated care. The following statement of Gas Co.’s medical director for Central Europe supports this reasoning:

“We spend 1 billion Euros per year in Germany for product group 14, therapeutic and medical aids, not including care. It would be 3 billion with care. This is increasing so massively, coming up to such threatening amount, for health insurance companies also, that this will trigger massive changes. We are convinced that new forms of patient care enable progress in this area.” (Interview #9)

The project introduced an electronic patient record that supports to transfer the patient from the hospital to the care center as well as to his/her home and back, ensuring a quality treatment at each partnering institution. Gas Co. trains the caregiving teams for home care-related practices and care is currently provided by qualified nurses that also work within the Arrive care centers.

Moreover, the project introduced an audio-video-conferencing solution that allowed caregivers and doctors, including the patient, to conduct regular and non-scheduled remote consultations. Caregivers collaborated by using the technology in two ways. First, as the EPR system offers an integrated view on the patient in different stages and by different actors, it allows for more consistency and a decreased need for reassuring communication. Second, by the means of teleconsultations, caregivers can access specialist knowledge from doctors more instantaneously, enhancing the nurses’ abilities and strengthening the Arrive centers’ role in the entire care process.

4.2 The Core of Gas Co.’s Innovation Path

Table 2 describes the extent to which the core and scope of the innovation path was extended or transformed within different episodes. It also refers to the employed resources in each episode. An expansion of the path would signify that Gas Co. has applied unconventional procedures and approaches to influence the path constitution process (Singh et al. 2015, p. 655).

Summary. As shown in Table 1, all depicted episodes have reinforced Gas Co.’s innovation path towards integrated care. The first episode was foundational as it is characterized by Gas Co.’s commitment to enter the market for long-term ventilation as such as well as by specific investments in practices, organizational structures and physical infrastructure that allowed further developments. In the following, we discuss reasons for the stabilization of the adopted path in the subsequent episodes.
Path Constitution in Integrated Care

<table>
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<th>Key Episodes</th>
<th>Innovation core</th>
<th>Innovation scope</th>
<th>Innovation resources</th>
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| 1. Market entry and competency building | Competence building in care for long-term ventilated patients, incl. infrastructure | • Gas Co. acquires care centers (physical infrastructure and equity)  
• Gas Co. builds new care practices and organizational structures | • Acquisition of specialized home care provider in respiration therapy |
| 2. Establishing “Arrive” as a quality brand | “Arrive” becomes a quality indicator for the care of long-term ventilated patients (internal, professional care standards) | • Definition of company-specific process standards from 2006 onwards  
• Implementation of qualification and training program from 2007 onwards  
• Introduction of internal quality management (ISO 9,001 certification) from 2009 onwards | • Recruitment of additional employees for training center by Gas Co.  
• Implementation of quality circles for process standardization |
| 3. National and international expansion | Scaling “Arrive” in and beyond Europe with telemedicine | • Implementation of standardized quality requirements and processes  
• Outside of Germany: integrating telemedicine and weaning services within the “Arrive” concept | • Gas Co. launches global excellence program  
• Early adopter of Arrive become “mentors” for other care centers |
| 4. First cooperation in an integrated care scenario | Implementing a standardized, defined patient workflow of integrated care with technical support and communication | • Definition of cross-sectoral quality indicators  
• Implementation of EPR system from 2013 onwards  
• Telehealth (audio-video consultation)  
• Ambient assistant living (tablet)  
• Access of partnering hospital on patient data via https/vpn interface | • Government funding  
• Collaboration with prestigious hospital |

Table 2. Status of the innovation path in core episodes

The second episode stabilized the path toward an integrated care model by institutionalizing previously implemented practices. Gas Co. also focused and re-adjusted the business model toward quality. By doing so, the company was preparing a third episode in which it scaled the model nationally and internationally. The foregoing standardization set in motion network and scaling effects reinforcing the commenced direction. The forth episode further expanded the scope by building integrated care routines. Importantly, these new routines complemented Gas Co.’s existing company identity because it chose a prestigious university hospital as a partner in the project which allowed the company to maintain its quality image. Gas Co. also envisioned that the collaboration of two prestigious partners and the related public attention would strengthen its own reputation. Finally, Gas Co. hoped that the project would spur future business in integrated care. The Global Business Manager of Arrive describes the situation as follows:

"We seek to co-operate with other, good ... companies in Germany, such as our main partner, but of course there are other large hospitals. The project is helping us to develop further what we’re doing today but we may also go in different directions.” (Interview #11)

Moreover, the project also aimed at implementing routines into a digital infrastructure for integrated care that linked Gas Co. and its partners. The next section details the technical aspects of the digital infrastructure that has been realized within the project.

4.3 Digital Infrastructure for Integrated Care between Gas Co. and it’s Partners

Building on defined inter-sectoral quality indicators, the project Breathe@home represented a major step toward inter-sectoral digital infrastructure for the integrated care of long-term ventilated patients. The project showed that significant groundwork at the site of each project partner was necessary to achieve that goal. One of the most profound prerequisites was the implementation of an electronic patient record. To do so, Gas Co. had to implement an EPR system (see Table 2, row no. 4). The company achieved to implement the system within the project time by building on a standard solution from a specialized vendor, customizing it to the specific context. The new EPR system became used for both everyday patient documentation within the Arrive care centers and for the newly established home care-related procedures, increasing its acceptance. The solution was also used to integrate the university hospital. By doing so, the project was able to realize an automated, inter-sectoral workflow. An electronic patient record and an
electronic physician letter were implemented to transfer patients more efficiently from the hospital to the care center. From an architectural point of view, the implementation team opted for a point-to-point integration, which allowed for a secured access of the hospital to the patient data from the care center’s patient record system. Whereas the original plan was to build a service-oriented architecture, the infrastructural preconditions and governance issues rendered this plan unrealistic within the project time. Defining and implementing an organizational governance and role concept was a crucial factor within the digital infrastructure development. The main pillars were secure communication mechanisms (https/vpn) and a role concept that allowed different stakeholders sufficient yet secure access to patient data within the process. In the future, it is planned to connect the new digital infrastructure to further source systems (e.g., the hospital EHR system, the care center’s financial systems, and national telematics infrastructures) to realize its full potential.

Moreover, a telemedicine solution and an ambient assisted living solution were piloted within the project. The telemedicine solution allows for remote consultations between doctors, care givers, and patients on a regular base and on request. This raised questions of security and access. In particular, it was problematic to access the teleconsultation solution from within the private network of the university hospital. The project team had to try out several alternatives until they could make do. The ambient assisted living solution—a tablet including the corresponding apps—was made available by a technical solution provider which modified it to fit the project requirements. One main feature was accessing training documents for the patients and his or her relatives. From an architectural perspective, main challenges arose when the project team realized that the telemedicine and the ambient assisted living solution were using different mobile platforms (Android versus Windows). Despite some delay, eventually both solutions could become integrated into the process. Both telemedicine and ambient assisted living were tested within the Arrive care centers but have not yet been integrated into Arrives’ regular care procedures on a broader scale.

Building on the results, questions remain on the extent to which the achieved solutions can be standardized and scaled to different contexts. As noted previously, some scenarios with respect to the telemedicine EPR system and the respective automated patient management workflows to other sites, nationally or even globally. Another aspect is the implementation of the cross-sectorial quality indicators and processes for long-term ventilation to other sites, especially in Germany. While the evaluation was still ongoing when we concluded this research, we gained the impression that quality did not suffer or could even be strengthened by installing the new processes and monitoring them consistently. Particularly the university clinic is insisting to make the quality guidelines, which were developed in the project, a national standard.

5. Concluding Remarks

Conclusion. Our aim in this paper has been to shed light on the organizational processes that predate digital infrastructure innovation. Based on the study of an integrated care provider, we tracked the constitution of an innovation path in integrated care in Germany over a period of 11 years (2005-2016). We found that within the process of developing organizational skills and competencies, the company had to constantly expand and adapt its skill base and its business model to balance institutional and internal requirements. Here, we highlighted a tension between market pressures from low-cost competitors on the one hand and the group managements’ image of the company’s identity as a quality service provider on the other hand. By repositioning the business model as a high-quality care provider and by making the newly acquired competencies complementary to the organizational identity, the company was able to scale the model nationally and internationally. This provided the necessary resources to master an integrated care scenario in which the company could eventually draw on its skills in telemedicine and from standardized processes to participate in the development of an inter-sectoral workflow and a digital infrastructure to support integrated care of long-term ventilated patients.

In conclusion, we have positioned our paper in the early phases of digital infrastructure development. Previous work in this line of the IS literature has highlighted the “startup problem” that arises if a digital infrastructure has not yet established a sufficient installed base. Enriching classical studies on the diffusion of innovations (Rogers 2003), it is argued that actors could draw on different strategies to overcome the startup problem and to enter a phase of self-reinforcing growth. Most importantly, our account concurs with the notion of “bootstrapping” (Hanseth and Aanestad 2003; Aanestad and Jensen 2011), which refers to entailing “how early adopters are attracted and enrolled into an envisioned information infrastructure that has not yet achieved strong network effects” (Sanner et al. 2014, p. 222). The primary outcome of this research is that bootstrapping can be seen as a collective action process in which different actors with
different goals come together and must align their individual strategies to let a new digital infrastructure gain momentum, e.g. by drawing on modular implementation strategies (cf. Aanestad and Jensen 2011). We added to this literature by bringing to the front the organizational readiness that individual actors must achieve before they can reasonably participate in bootstrapping a digital infrastructure. In particular, we have figured centrally the tensions on the organizational level that actors must balance to achieve such readiness and to persist before bootstrapping can start.

Limitations. We highlight three conditions that limit the transferability of our findings. First, our study is limited by the nature of the qualitative method we have adopted. We drew on a single case-study in an integrated care setting. The case is, in many respects, specific to the regulatory and institutional conditions of the German healthcare system. However, we believe that many of the challenges mentioned in the case also generalize to similar organizational forms in other countries, such as Accountable Care in the U.S., coordinated care, or managed care. Second, we attended only the earliest stages of innovation in the area of digital infrastructures. This kept us from linking the processes that predate digital infrastructure innovation to the scaling of these infrastructures. While the provision of this link was not our point, future research may thus adopt even longer time frames and study how events in the earliest stages affect the scaling of infrastructures. Third, given our single case study we could point to but not control for factors such as size or status of innovators. Gas Co. is a big firm and its partner is a highly renowned university hospital. These conditions could favor the potentials to become forerunners since the factors imply that Gas Co. has more resources available than smaller competitors and that legitimacy is ascribed to that innovation by the field due to the involvement of a high status partner. Future research should thus look into whether and to what extent these factors affect the processes that we observed.

Practical implications and outlook. From a societal perspective, the design of digital infrastructures for integrated care and related home care models (such as the Netherlands “Buurtzorg” model; see Monsen and de Blok 2013) is an important policy challenge. Based on the approach that we have outlined, we put forward three preliminary practical conclusions. First, we showed that the nucleus of digital infrastructure innovation may often already exist within the knowledge and skill base of an organization. Thus, policy makers may in the future more often nurture existing knowledge from the bottom-up instead of trusting in top-down strategies. Second, we have highlighted the importance of establishing standards in small, organizational contexts first that can then diffuse on a regional or national level. Third, we have built a case for viewing the establishment of a new digital infrastructure as an ongoing process that starts long before the actual infrastructure is set up. This calls for a long-term view, acknowledging the importance of preparing the ground first before one can see tangible results. To broaden our knowledge on these importance challenges, we are eager to see further—qualitative and quantitative—studies on the unique challenges of digital infrastructure innovation in integrated care scenarios.

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