Standards-Based Delivery of Multi-Contextual Services:
On the Identity Tension

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Abstract

There has been little theorizing so far about the creation of new standards-based information services in public organizations. In this paper, we explore through a longitudinal case study at the Swedish Road Administration (SRA) how two standards - Alert-C and Location Code - were adapted as to deliver a traffic information service called RDS-TMC. Our in situ analysis reveals that the inherited norms, roles, and rules of the public organization hampered service delivery, which eventually created a tension between the old identity and the new identity of SRA - a tension we refer to as identity tension. Undergoing identity change, SRA had to deliberately configure infrastructural capabilities to better align its operational logics to the new service requirements. The findings suggest that digital multi-contextual services pose intriguing challenges for organizational identity among participating organizations.

1. Introduction

Driven by increased mobility, digital convergence, and mass-scale [30], today's information technology (IT) solutions offer a growing number of simple standards-based information services such as location-based services to increasingly nomadic users [see e.g., 21; 30; 34]. These services deliver messages about limited physical and social worlds- i.e., events, objects, and states classified into a small pidgin language- to a particular community [3]. They share properties of consumer services by being heterogeneous, intangible, and perishable [5; 47]. They often require that consumers, producers, and other stakeholders engage in value co-creation [45; 44]. Finally, given that these services increasingly span contextual boundaries [20] their use patterns evolve and vary unexpectedly [27].

Not surprisingly, due to the centrality of standards in service driven infrastructural innovation, a growing number of IS researchers have heeded to the problems of creating, negotiating, and adopting IT-related standards [see e.g., 29]. Less attention, however, has

been paid to the question of how to organize effectively for service implementation and what adaptations are needed. The few studies available highlight challenges created by the generic nature of the standards and their local adaptations [16; 10].

The challenges associated with standard implementation are amplified when these standards must induce novel use behaviors [3; 20; 27]. In this case, information services and their underlying infrastructures are created *de novo* by implementing a set of anticipatory standards and unforeseen services [11; 15; 28]. Recent research suggests also that these new services will in all likelihood spark tensions [26] about what the services mean and how they should be used. Henceforth, the service organization must, in response, adapt the services constantly by changing its responses and even finally its identity [12; 38].

In this paper, we posit that offering new digital information services will often question the organization's current identity [see e.g., 43]. We therefore examine how service organizations can constantly navigate and reconcile identity tensions that arise during the service delivery by configuring their infrastructural capabilities and adjusting the ways in which they organize. Organizational identity is a set of norms that represent shared beliefs about what is core about an organization and legitimate behavior for an organization with that identity. An identity tension is defined here as a gap in how an organization continues to define and legitimate its role and relationships to its environment when its salient relationships to the environment change [cf., 9].

We explore how organizations can deliberately transform their identity by constantly adapting norms, redefining roles, and establishing rules as they respond to new service delivery demands [cf., 7; 14; 43; 48]. Extant IS literature, however, provides little guidance on how organizations can effectively manage these adjustments and change their identity. Addressing this gap, we examine the following research question: *How can organizations evolve their service delivery while configuring their infrastructural capabilities in ways that will reconcile identity tensions?*

We address this research question through a longitudinal case study of the Swedish Road Administration's (SRA) successful endeavor to organize for the delivery of the RDS-TMC traffic information service. This service is the only language-independent mobile traffic information service in Europe. Two Pan-European anticipatory vertical standards, Alert-C and Location Code, specify the functional nexus of the service by offering an anticipatory vertical 'grammar' for communication between multiple actors and systems [cf., 10; 18]. We engage in theory building by exploring how SRA configured infrastructural capabilities to reconcile an emerging identity tension, i.e., how it changed its norms, roles, and rules that eventually hampered successful service delivery.

2. Theory

The notion of multi-contextuality was originally invented in the telematics area to design effectively service platforms capable of synchronizing fluid use patterns, scaling service manipulation, and signaling context-switches [20]. Recent research has also explored socio-technical consequences of multiple use contexts for boundary-spanning practices [27]. While these studies recognize the role of standards in enabling multi-contextual services, they do not focus on service organizations that adapt standards and build infrastructural capabilities as to deliver information services across multiple contexts.

Multi-contextuality entails that the information service needs to be delivered across a multitude of contexts populated by an unknown and varying set of actors and technologies. Hence, the 'system' delivering these services will comprise of multiple heterogeneous social and technical components involving complex dependencies [40]. Such a system is typically denoted an information infrastructure defined as "a shared, open, heterogeneous and evolving socio-technical system consisting of a set of IT capabilities and their user, operations and design communities" [17, p. 4].

The high level of complexity of information infrastructures can be traced back to: 1) variation in the evolution of technologies and their use patterns [3]; 2) different time scales in which varying components evolve [17]; and 3) differences between how actors appreciate and interpret the technology and service components in relation to their interests [14].

While there are multiple ways to manage complexity, infrastructure designers usually aim at achieving agreements about key infrastructural components and their interfaces in the form of standards [18]. Anticipatory vertical standards inscribe technological, business or process innovations into the technical specification [11; 28] in contrast to recording and stabilizing existing capabilities and/or practices de facto. Such standards for multi-contextual service delivery cover definitions of general linguistic rules that govern the structure of the messages as well as the routines for producing them (i.e., when, how, and why). Like Electronic Data Exchange and advanced XML-based standards, they thus describe relevant business processes, define data structures, outline non-functional requirements, and prescribe document formats [4; 31; 33].

Any service organization desiring to offer information services needs to erect a new socio-technical configuration based on anticipatory vertical standards. However, infrastructural capabilities garnered by the service organization will only provide the critical mechanisms to implement such standards as integral material practices that underlie the service and ensure the constant reproduction of appropriate behaviors. This is a prerequisite for consistent and predictable delivery of the service. Indeed, the service organization needs to respond to the tensions that inevitably will emerge during service delivery [12; 38] by reconfiguring the capabilities necessary to generate positive service effects.

For service organizations such reconfiguration of infrastructural capabilities involves adapting norms, redefining roles, and establishing rules [cf., 7; 14; 43; 48]. Given that identity becomes intertwined in the actions, beliefs, procedures, and routines of both organizational and external constituents, explicit efforts to shift identity to accommodate identity-challenging technology are difficult. Organizational identity is a set of norms that represent shared beliefs about what is core about an organization and legitimate behavior for an organization with that identity. While internal identity guides actions and interpretations of organizational members, external identity captures how outside audiences such as institutional actors, customers, suppliers, or complementary producers view the organization.

Having categorized an organization in a particular way, both insiders and outsiders ascribe specific characteristics with it and form certain expectations or codes about how the organization should act. In case an organization deviates too far from the rules of a clearly defined category, it may trigger ambiguity and confusion both internally and externally what is the identity of the organization [43]. These processes sometimes play out incrementally, but they can also be more discontinuous and sweeping. As for the latter, Corley and Gioia [9, p. 173] argue that such identity tensions make it difficult for members to make sense of "who we are as an organization". To resolve the "who are we?" question they argue further that organizations

must take steps to undergo identity change. We adopt this concept of identity tension as a lens to understand how SRA dealt with its identity change to sustain effective RDS-TMS service delivery.

3. Method

3.1. Case Setting

The RDS-TMC[1] service is currently the only standardized language-neutral and dynamic traffic information service in Europe. It offers mobile users filtered real-time information for immediate route selection in their preferred language. When the service was delivered initially in 1997, it was intended to cover at least the "Trans European Road Network", and be available 24/7/365.

SRA offered the first RDS-TMC service worldwide in Sweden. The service is available (free or for low-cost) in most West European countries. It is offered now also in Australia and the U.S., and has been demonstrated in China and a few other countries worldwide. Indeed, the RDS-TMC service is becoming a truly global technology. The number of users has also steadily increased, and there are currently 3 million installations of RDS-TMC receivers in Sweden alone.

The RDS-TMC service forms the first truly multi-contextual traffic-based information service, because it provides drivers dynamic information about accidents, congestions, construction work, and road conditions across countries and multiple driving situations on heterogeneous terminals. Any willing national, regional or local broadcaster can transmit RDS-TMC messages. By current agreements national service providers can also broadcast cross-border messages for long-distance/international drivers.

The RDS-TMC service is based on two anticipatory vertical standards: Alert-C (ISO 14819-1: 2003, ISO 14819-2: 2003) and Location Code (ISO/TS 14819-3: 2000). Their standardization was started in 1982, and the first full standard was released in 1995. The development work was organized and coordinated by CEN (European Committee for Standardization). Alert-C and Location Code were ratified as standards by ISO in 2004. During 1995-2007, the standards were maintained by TMC Forum[2], which merged into TISA (Traveler Information Services Association)[3] in 2007.

As for Alert-C, the standard document 'ISO 14819-1: 2003' specifies the protocols that define the message structure and how messages are transmitted and received. The standard document 'ISO 14819-2: 2003', in turn, describes both the data structure and the content of the event list. In addition, the Alert-C provides guidelines for how the RDS-TMC service should be implemented, and presents a classification of actors that guides the identification and establishment of roles (i.e., broadcast operators, car manufacturers, map suppliers, network operators, public authorities, receiver vendors, and service provider) and relationships necessary for service delivery. With regard to the Location Code standard, the document 'ISO/TS 14819-3: 2000' specifies rules for how places (related to the road network) should be coded and identified.

SRA's key mission is to build a safe, environmentally sound, and gender-equal road transportation system by cooperating with multiple stakeholders. Therefore, SRA recognizes therefore new services such as RDS-TMC as an important means to offer drivers and the business community relevant traffic information and thus improve transport quality. Currently, SRA[4] is the sole RDS-TMC service provider, delivering the service through a collaborative public-private effort[5]. SRA has established a socio-technical information infrastructure that supports RDS-TMC service delivery[6], which involves encoding, validating, and integrating various data sources (e.g., traffic flow data, incidents, weather etc.), furnishing the data to the broadcaster, and, finally, transmitting the traffic messages.

3.2. Research Approach

Given the explorative nature of our research objective, which involved studying a research

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[1] The Traffic Message Channel (TMC) is a specific application of the FM Radio Data System (RDS) used for broadcasting traffic and weather information. TMC traffic information systems build on a global standard being adopted by broadcasters, information service providers, traffic data gatherers, and vehicle/receiver manufacturers.

[2] TMC Forum is a non-profit consortium including broadcasters, car manufacturers, map vendors, public authorities, service providers, and receiver manufacturers (www.tmcforum.com).

[3] For simplicity reasons we use the acronym 'TMC Forum' when talking about the standardization organization.

[4] Since April 1 2010 SRA is part of the Swedish Transport Administration (STA), see www.trafikverket.se. For simplicity reasons we use the acronym 'SRA' when talking about the service delivery organization.

[5] SRA has collaborated extensively with actors such as Destia Traffic (traffic information service provider), Mitsubishi (receiver manufacturer), Navtech (map database supplier), Teracom (network operator), and Volvo (car/truck manufacturer).

[6] SRA established seven regional traffic information centers in Sweden to cater for the RDS-TMC service delivery.

phenomenon through the lens of multiple meanings people assign to it [36], an interpretive research approach was deemed appropriate [46]. We followed narrative and grounded theory strategies [24] in making sense of the data and generalizing towards theory. Being a longitudinal study, the study period runs from fall 2001 until summer 2011. The long time span of the study allows us to explore not only the ways in which the standards were implemented and then adapted based on use experiences, but also examine how SRA reconfigured over time its infrastructural capabilities as to improve the delivery of the service. In particular, by exploring the path dependent nature of the RDS-TMC service evolution, we were able to gain a thorough understanding of the emergence of the identity tension as well as the associated responses orchestrated by SRA and TMC Forum to resolve it.

Data covering the entire lifespan of SRA's delivery of the RDS-TMC service were gathered from seven sources: 1) direct observations of traffic message production at centers; 2) field notes made during standard and service development meetings at SRA and CEN; 3) semi-structured interviews at SRA and among other stakeholders; 4) e-mail and telephone conversations with strategic and technical service managers at SRA; 5) regular informal meetings with the strategic service manager at SRA; 6) participation at system and technology demonstrations; and 7) reviews of documentation about the service.

Additional archival data were acquired from the TMC Forum covering documents that described strategies and plans for the implementation and use of the standards in different countries. Overall, capturing multiple voices was deemed critical for data triangulation and theory development [22], and the multiple data sources tapped into increased our ability to triangulate data and validate the emerging theory.

Our primary data set was generated over a ten-year period through interviews with 35 people. The interviews covered all key actors in standard development and adaptation. In SRA, we interviewed 22 people occupying different roles, including head of service management, strategic and technical service managers, system administrators, and operators and coordinators at traffic information center. We used a snowball method, where key informants at SRA helped identify new potential interviewees who were well placed to comment on the topic. We also conducted interviews with four telematics managers at Volvo, and one navigation system designer at Volvo Cars who all had extensively been involved in SRA´s research and development projects. In addition, we interviewed three consultants who actively participated in the standardization, one R & D consultant who is involved

in an ongoing open platform project between SRA and Volvo, and four people (2 academics and 2 practitioners) having extensive knowledge about SRA's process to develop the new ITS action plan.

The overall data analysis strategy was designed to fit the nature of our research objective. Given our identity change lens, we sought to generate and validate empirical categories that would capture essential socio-technical aspects of the fit between the operational logics of SRA and the RDS-TMC service. Concurring with the hermeneutic circle [22], new empirical categories were generated over time while working with the data in an iterative fashion. Armed with an increased understanding of the phenomena, the categories were continually refined to better reflect delivery practices, identity tensions, capability configurations, and related socio-technical responses [41]. Over cycles of deepened insight, our analysis was gradually geared towards classifying and generalizing the responses orchestrated and implemented by SRA and TMC Forum.

4. Findings

In order to deliver the RDS-TMC service SRA had to build the socio-technical flesh around the Alert-C and Location Code standards. That is, a new socio-technical infrastructure within its realm that would generate the specified service by conforming to the standards. Since the start of the service initiative back in the early 1990s, SRA has successfully engaged in 1) development of new IT capabilities that offer the storage, processing, and data communication capabilities required by the service, 2) invention of organizational routines that integrate the sense-making and production of linguistic messages across the whole "production" pipeline to deliver the service, and 3) creation of organizational mechanisms, tasks, structures, and accountabilities that coordinate and manage the service.

Over time, however, establishing the routines in the form of procedures and habitual practices to institutionalize the RDS-TMC service proved difficult for SRA. The fact that the norms, roles, and rules of the organization hampered effective service innovation eventually created an identity tension. It was deemed a serious challenge indeed that SRA served as main service provider because of its focus as an authority responsible for physical road infrastructure. The strategic manager of the RDS-TMC service explained:

"SRA is an old-fashioned authority primarily focusing on road construction and maintenance. Our key lesson learned is that service delivery is not our core business. We're not the appropriate organization, and

we don't have the knowledge and competence required. All of this has created uncertainty about our function and role."

This uncertainty forced SRA to develop a new identity, by inviting its members and external constituents to alter their deeply held assumptions and beliefs about what the organization stands for. A telematics manager at Volvo argued:

"Given the organization's design and structure, I don't think it's suitable for SRA to function as a service provider. They did fine initially… but then it hasn't worked our very well. We've clearly communicated that we're not happy with the way the service been delivered. The core business needs to be delivery of traffic information. SRA's core business is something else. They focus on cement and asphalt… that roads and physical infrastructure are built correctly. SRA's mission as an authority binds them, but I know they worked a lot with finding a different identity and creating new organizational routines."

The head of service management at SRA argued, however, that the industry wrongly blamed SRA alone for the slow innovation. Actors in the automotive industry like Volvo, for example, tend also to struggle with their identity and structure when it comes to service innovation. Those in charge are still mainly experts on cylinders, pistons, and varnish rather than people with a deeper know-how of electrical systems, IT applications, and digital infrastructures.

Further service innovation has also been undermined by the meager support from the state, the virtually non-existent collaboration with telecom actors capable of leveraging the infrastructure, and the lack of commitment of individual firms to go beyond advanced technology demonstrations. A telematics manager at Volvo reflected upon the service arrangement:

"It would have worked better if a public-private partnership organization had been created at the outset… that would have allowed for use of many of today's available traffic information channels. This requires a freedom to collect information and data from diverse sources, and a mix of actors is a necessity for creating and maintaining quality. Maybe there must be multiple service providers as to create competition and leverage dynamism… you can collect data from individual drivers as well as commercial actors. We need more automated systems such as floating car data and sensors embedded in the physical traffic infrastructure that continually produce and

report… this requires atomization of message flows from the service."

Due to these challenges SRA in 2008 eventually decided not to continue as the main service provider. Soon after it was decided that Destia would replace SRA. Even though their primary task in the past had been to deal with customer relationships and service agreements, it soon became clear that they would have a hard time to find a viable business model for the RDS-TMC service. It was unclear whether Destia would promote the RDS-TMC service alone, or whether they would bundle the service to other services. As the head of service management at SRA explained, Destia's ability to maintain quality and reliability of the RDS-TMC service across the country was deemed questionable. SRA reclaimed in 2009 the service back. However, this decision signaled a new approach towards information related services as part of the SRA mission. A navigation system designer at Volvo Cars noted:

"SRA decided to open up and supply their information to other actors… I think that's the way to go. The argument behind this approach is to create the potential for generativity… replacing authority and control as driving forces with incentives that motivate other actors to plunge in and help them to realize their goals. This can be difficult for SRA especially given their history as a dominating actor required to make political decisions about technology investments. I believe Alert-C and Location Code have a large installed base… they represent a dominant design capable of enabling an infrastructure that builds on generativity and allows for a heterogeneous business approach that activates many creative brains. What is required is that they [SRA] tie things together in a new way."

In response to the growing identity tension, SRA had to configure new infrastructural capabilities to shape standard development and service diffusion. Since 2009 SRA has developed a more encompassing ITS service action plan with strong support from the government. The goal is to create organizational capabilities through which SRA can leverage the public-private coordination and engage in innovation necessary for the further advancement of the RDS-TMC service. As explained by the head of service management at SRA, this initiative integrates with the new service innovation programs pursued by Ertico - ITS Europe and others as to improve TMC Forum and the RDS-TMC service.

Furthermore, SRA participates in new TMC Forum initiatives that seek to further develop the standards so

that they better communicate what actors should be part of service delivery, and how the relationships between them should be organized. Such improvements are expected to make it easier for SRA to appreciate how to deal with emerging technologies (e.g., broad bandwidth, location-based services, sensors etc.). SRA is also involved in open platform projects to find new ways to collaborate with private actors and third party developers. An R & D consultant commented on one of the projects:

"ITS services are to be offered via an app store and it shouldn't make a difference for the customers whether the services are being developed by Volvo or someone else. The app store is a portal that serves as a distribution channel for traffic information. Volvo Online Service Store can therefore become a marketplace for ITS innovation. It will resemble the logic of a double-sided market or rather a multi-sided market. SRA won't offer anything directly to end customers. They'll rather provide content like RDS-TMC or Floating Car Data to third party developers seeking to use SRA's resources for developing customer apps. SRA is responsible for assuring the quality of the data they supply to third party developers, but cannot control how the data sources are then used to create customer offerings and services. If SRA would dictate the terms of usage the incentives would soon be long gone. This is virtually the only way we can go to allow for commercial use of SRA's data. We want to create an ecosystem or ecology where various actors complement each other."

While SRA handles currently a large amount of information and applications (road incidents, travel times, traffic flows etc.), it can potentially provide more societal utility through such service collaboration. Reflective of a public-private business model intended to create a win-win situation for both parties, the idea was that SRA would supply information to Volvo free of cost. As soon as the arrangement contributes to the fulfillment of the general political goals concerning transportation it would become part of SRA's portfolio already being financed by the government. These goals are central for SRA legitimacy, because it is not solely evaluated based on its financial performance. While there has to be a dialogue to establish such collaboration, it proved to be difficult because of their different agendas. For example, SRA is uncertain about the relationship between the level of its IT investments and the societal benefits in terms of fewer accidents, saved lives, shorter transportation times, or environmental effects.

5. Discussion

5.1. Service Delivery

In the service literature, technology is typically recognized as a medium that offers an opportunity to provide innovative services. For example, it can serve as a repository and delivery mechanism for customer information, or as a process tool that caters for customer involvement during value co-creation [6]. Technological choices and their implementations may therefore have a significant impact on a service organization's capability to create attractive services [35]. In this vein, it has been noted that the potential utilization of IT in service delivery raises new fundamental questions [45]. Overall, it is unclear how IT influences all ways in which service value can be created effectively. Despite calls for research on the nature and role of IT in enabling service systems and value creation, detailed studies of such phenomena are largely absent in the service literature.

Not surprisingly, this growing debate about IT's role in services has triggered IS researchers to enter the service domain with a deliberate quest for novel research opportunities that concern digitalization of services [5; 47]. As early as a decade ago, Lyytinen and Yoo [30, p. 378] envisioned that computing services were about to change and become multi-contextual: "In the past, computing services were always provided in a stationary location. Accordingly, users had to come to the physical site to receive the service. For example, a user of a desktop computer needs to come to his or her office to use it.

In a nomadic information environment, however, all this will change: services will come to the users whenever and wherever they are needed". Given that such settings change constantly, their inherent dynamism complicates the design and implementation of service features that can transcend multiple contexts of use. Indeed, anticipatory vertical standardization as a baseline for extensive service development and coordination represents one such research opportunity. Yet, our study is one of the first studies to heed as to how and under what conditions such standards can become key enablers for multi-contextual service innovation that transforms an organization's identity.

Ten years ago, we set out to explore how anticipatory vertical standards and their infrastructural implementations need to be adjusted by service organizations as to leverage multi-contextual service delivery. In line with a recent call for longitudinal analyses of infrastructural change [42], the design of our exploratory case study of SRA allowed us to capture the entire life history of the adaptation of the RDS-TMC service. Our study of the service evolution

offers a unique narrative of the genesis of a traffic information service industry, echoing the observation that "a system with thousands of users might be worthwhile, but a system with millions of users is an industry" [12, p. 370]. SRA and its partners can be regarded as erectors of one of a first kind of a standards-based information infrastructure that supports a multi-contextual traffic information service. Our empirical lessons, however, indicate that the successful outcome of their efforts did not emerge without struggle. Overall, one of the steepest hurdles they faced while delivering the RDS-TMC service was the identity tension it eventually generated.

5.2. Identity Tension

The identity tension [cf., 9] was concerned with the fact that the existing norms, roles, and rules were considered problematic and/or unacceptable while delivering the new RDS-TMC service. New public-private partnerships had to be formed at the heart of the RDS-TMC service, which heightened this tension. This has indeed proved to be difficult in many situations. Trafficmaster, which originally was the RDS-TMC service provider in Great Britain, is one illustrative example. Because of the Department of Transport's reluctance to deliver requested traffic information to outsiders, a group of private industry players found a loophole in the law that allowed them to collect the information by installing sensors on viaducts. Trafficmaster was thus born out of anarchy and suffers still from poor public-private collaboration.

Though Alert-C specifies a generic classification of actors intended to guide the identification and establishment of roles and relationships necessary for service delivery it is not very detailed in this specification (especially about accountability and cost). These roles include broadcast operators, car manufacturers, map suppliers, network operators, public authorities, receiver vendors, and service providers. In addition, the initial success in the delivery of the RDS-TMC service broke down the traditional roles as it endorsed more public-private cooperation [cf., 19]. This put pressure on the unity and identity of each role [37], ultimately highlighting differences between public and private organizations [8].

In particular, the uncertainty about who should take on the role as main service provider affected negatively over time the service quality. While traffic information sources making the service more dynamic and attractive have been available, the growing ambiguity around identity has resulted in only a few quality improvements. The continued delivery and refinement of the RDS-TMC service thus requires that the new mission of the organization operating as the service

provider be clearly articulated. SRA has over the years done its best to organize and execute the information service delivery. From a historical perspective, however, the organization's mission has involved mainly building and maintaining physical roads. Consequently, SRA is still reluctant to see itself as serving as an information service provider. One indication of this is that in 2008 it initiated an unsuccessful effort to outsource the RDS-TMC service to a private service provider. Besides SRA, other actors have also struggled to define and negotiate their role in the service arrangements. For example, Volvo's core business is car and truck manufacturing, while IT services like those utilizing RDS-TMC are becoming increasingly important [cf., 25].

To establish the 'rules of the game' that could support RDS-TMC service delivery, the parties have been constantly obligated to develop clearer alternative norms, new roles, and change rules that would determine more clearly who is responsible, who has authority over whom, and what sort of accountability is to be expected. SRA and TMC Forum orchestrated socio-technical responses at the information infrastructure and standard development levels to promote such clarifications. At the information infrastructure level, SRA is currently in the process of redefining its role in the Swedish transportation sector. The ambition is to become an authority that not only builds and maintains physical roads, but also innovates and develops digital services related to transportation. IT services are deemed to become a critical instrument in promoting many policy goals of SRA like efficiency, safety, and sustainability. However, this does not necessarily mean that SRA wants to remain a dedicated provider of all digital transportation services.

SRA has recently developed an action plan for IT services, which prescribes how it will cooperate with business actors in the transport sector. This plan articulates, for example, tactics for collecting and managing traffic information as well as regulating ownership and service delivery conditions. It is deemed essential for improving the public-private partnerships [23] required to spur further RDS-TMC service innovation. As an instantiation of the new agenda, SRA has recently been involved in several open platform projects. For example, the 'Volvo Online Service Portal' was a deliberate attempt to stimulate the emergence of a multi-sided market [13] made up of an ecosystem of heterogeneous actors, platforms, and services [1; 2]. The idea was that Volvo would cater for an 'App Store' to which SRA and others could supply their digital information and services. In this arrangement, by becoming a supplier to Volvo, the digital content that SRA provides could be delivered in new ways to customers. However,

whether such a public-private business model has the potential to become viable and actually work remains to be seen.

At the standard development level, TMC Forum has launched several initiatives that seek to help their members in establishing viable public-private alliances that enable ITS innovation worldwide. While the new service innovation programs primarily address the business side of digitalization of transportation, the standardization networks they have brought together deal also with the technical challenges. The social and the technical aspects are deemed equally important, and TMC Forum believes that the combined effect of these initiatives will increase the diffusion of high quality information services. The RDS-TMC service is seen as the most successful ITS project so far at the European level, and therefore it serves as a reference case for further innovation. Many member organizations are actively involved in this ongoing capability building accumulation. As part of this, SRA has played a pivotal role in developing and maintaining global standards for traffic information.

5.3. Research Opportunity

Our study of SRA's journey suggests that the implementation of anticipatory vertical service standards will eventually put pressure on the identity of the service providers, thus reshaping the relationships between involved public and private organizations. So far, the IS literature on standards implementation has failed to account for how challenges to identity affect service delivery. Lyytinen et al [28, p. 8] hint at such challenges when they note that most studies "suffer among others weaknesses in accounting anticipatory ICT standardizing as collective engineering in specific institutional contexts. From the ANT viewpoint this introduces a challenge in explaining who should be enrolled, why, and how, and what is the organization of the network when design is fluid, shifting, and ambiguous".

Given that multi-contextual services will become increasingly prominent, IS researchers must explore what social mechanisms condition the ways in which service-oriented anticipatory standardization evolves. A contributing factor to the somewhat slow innovation of the RDS-TMC service case was the absence of a viable public-private business model. All actors shared the vision that taking the next step requires that the service be attached to an ecosystem of heterogeneous actors, platforms, and services [1; 2], but there is no single good model to do so. Indeed, the Volvo Online Service Portal was one attempt to realize the vision.

Therefore, more studies of multi-sided markets [13] are necessary to understand the enabling mechanisms for multi-contextual service delivery. We need to analyze how and why the technical infrastructure alongside with norms, roles, and rules facilitate or impede service arrangements and their evolution. The creation of a multi-sided market structure that boosts multi-contextual service delivery requires, however, that financial and intangible incentives and related performance measures be integrated. Given that the public-private partnership aspect [23] of multi-contextual service delivery has remained largely unexplored, future studies need to heed more toward strategic implications of such arrangements in standards-based digital innovation.

6. Conclusions

Many of today's consumer products such as cars and telephones are increasingly equipped with advanced computing capabilities like sensors. Smart cars and mobile digitalized devices can therefore send and receive information about their states, locations, and movements. Such multi-contextual services create opportunities for user behaviors not seen in the past, ultimately changing the concept of service in our society. The multiplicity of devices, contents, and networks means that virtually any service can eventually become multi-contextual. While the experience of using such service is truly intangible, however, its delivery is a tangible thing involving a truly complex array of heterogeneous and often autonomous technological and social elements.

Our study suggests that anticipatory vertical standards capable of aligning heterogeneous actors and technologies will constitute one of the building blocks of information infrastructures associated with multi-contextual service delivery in the future. SRA's history with the RDS-TMC service provides initial insights into why not only public but also private organizations will find multi-contextual service delivery processes to be challenging. Organizations that desire to provide such services will inevitably face pressure to adjust their norms, roles, and rules vis-à-vis new models for business logic, data ownership, and revenue sharing. Indeed, anticipatory vertical standards will increasingly align these organizations into dynamic networks that comprise complex ecosystems.

Our study also suggests that multi-contextual service arrangements like the one enabling the RDS-TMC service will continue multiply and invite new knowledge of standards and their implementation strategies. That is, services that travel across time and space pose novel design requirements. We are strong in our belief that IS researchers are particularly well positioned to take a proactive role in forming the infrastructural knowledge that underlies services that

we cannot yet imagine. The account offered in this paper can serve as a common template for future research on multi-contextuality and related service innovation. We hope that this will establish a cumulative research tradition on the implementation of standards-based digital services so that better theoretical understanding of factors, events, and actions affecting them can be acquired.

7. References

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