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Interoperability for mobile payments: Benefits, Challenges and the ways forward

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Abstract

Interoperable mobile payment platforms play an important role in the continued development of mobile payment services. Thus, mobile payment service providers has a challenge to not only developing new services but also developing platforms enabling the innovative payment service. Thus, interoperability becomes a feature that leads to increased volume of transactions, positive network effects, achievement of broader goals of platform efficiency, reduction of platform cost, better customer value and eventually increased choice for the customers. This interoperability may, on the other hand, stand a risk of being hurt if mobile payment services are developed independently by single mobile network operators or banks. An occurrence of repeated failures to build effective platforms indicate that the task is not only challenging but also poorly understood.

Consequently, a lack of interoperability has been addressed as a major barrier to the expansion of mobile payment services. This study, therefore, reviews the concepts of interoperability in the context of the mobile payment services and describes related challenges that platform providers face when aiming to achieve interoperability in platforms for mobile payment services. Design/methodology/approach This study adopted the literature review methodology to review and analyzes articles related to interoperability in the context of mobile payment services. We used the Social Sciences Citation Index (SSCI) of Web of Science Core Collection (WOS) and, Scopus. Findings The paper addressed interoperability, as is not mainly a technical issue (i.e. standardization), especially in the context mobile payment services. To understand interoperability challenges, we need to consider strategic factors such as the cooperation among payments providers as well as and regulatory issues. Our study suggests that interoperability is a major barrier to realizing mobile payment services. Practical implications The paper includes implications for an interoperable mobile payment platforms. Moreover, the study provides a better understanding of the context and, therefore, insights that potentially could contribute to an innovative payment ecosystem. Originality/value This paper fulfills an acknowledged

need to study the role of interoperability for innovation in the context of mobile payment services. One main conclusion is that a high level of interoperability builds on a need for cooperation among rivals actor (Coopetition) in the system. Keywords: Interoperability, mobile payments, mobile payment platforms, Coopetition Article Type: Review paper

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Interoperable mobile payment platform plays a significant role in the continued development of mobile payments. Thus, mobile payment providers can easily work as a platform to enable the creation of new payments platforms or services. However, the role of Interoperability in platform achievement, it is not a goal itself. Thus, Interoperability acts as a tool to increase the volume of transactions, positive network effects, achieve broader goals of platform efficiency, reduction of platform cost, customer value and eventually increased choice for the customers. This Interoperability is mainly because mobile payment services have been developed independently such as mobile network operators or banks. This independence result in repeated failures to build efficient platforms indicate that the task is not only challenging but also poorly understood. Consequently, a lack of interoperability has been addressed as a major barrier to the expansion of mobile payments. This study, therefore, reviews the concepts of interoperability in the context of the mobile payment service, its benefits, and describes its related challenges that platform providers face in achieving interoperability to develop mobile payment platforms.

Design/methodology/approach this study adopted the literature review method to analyzes articles related to interoperability in the mobile payment context.

Findings The paper addressed interoperability, as is not mainly a technological, especially in the mobile payment context. To examine the whole of the interoperability challenges, we need to consider strategical factors such as the cooperation among payments providers and regulation issues. It suggests that interoperability is a major barrier to realizing the benefits of mobile payments.

Practical implications the paper includes implications for an interoperable mobile payment service platforms. Moreover, the study provides payments providers a better understanding of the context and, therefore, a better opportunity to contribute to an innovative payment ecosystem.

Originality/value This paper fulfills an acknowledged need to study how interoperability can be enabled in mobile payment context. One main solution has been proposed to achieve a high level of interoperability there is a need for the cooperation in the ecosystem.

Keywords: Interoperability, mobile payment, mobile payment platforms

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1. Introduction

The term “m-payments” generally refers to financial transactions by means of a mobile device using wireless and communication technologies (ICT) to enhance payment services (Chandra et al., 2010; Lu et al., 2011; Dahlberg et al., 2008). Thus, an m-payment service is a type of the digital platform (Kazan and Damsgaard, 2013) and can be viewed as a multi-sided platforms, which brings together two or more entities to create value for the affiliated providers (Hagiu and Wright, 2011,2015). These entities include providers (i.e. mobile network operators (MNOs), banks) and or user levels such as consumers and merchants (Gannamaneni et al., 2015).

In the m-payments service context, transactions between platform providers should be interoperable (Au and Kauffman, 2008; Dahlberg et al., 2008; Gannamaneni et al., 2015). Interoperability enables ICT systems to facilitate transaction exchanges and promote service compatibility between platform entities (Mattiello-Francisco et al., 2012; Truex et al., 1999). Therefore, interoperability in an m-payments context has become a critical issue (Boer and de Boer, 2009; Gannamaneni et al., 2015).

Interoperability in the m-payments context has several definitions such as “Interoperability should base on standards and open technologies to allow for interaction between components or systems on a global scale at all levels” (Karnouskos and Fokus, 2004 P. 46). The aim of interoperability is to establish a common standard for different systems (Gannamaneni et al., 2015 P.1167).The European Commission’s has proposed a European interoperability framework (EIF) as follows: “Interoperability means the ability of information and communication technology (ICT) systems and of the business processes they support to exchange data and to enable the sharing of information and knowledge” (European-Commission, 2010, P.5).

Achieving “m-payments” services interoperability generates numerous benefits such as the flexibility for users to switch between different service providers, and facilitating significant volume and numbers of transactions expeditiously. Therefore, interoperability can provide more accessible and flexible service to the users. A recent report (2015) of the European parliamentary research service ,point out that the lack of interoperability can lead to fragmentation in the market through dominated solutions offered by key providers who control the interoperability of m-payment service ecosystem. This control dominates m-payment service platform, application and security elements .In 2012 European Commission published a green paper which, claimed that there is a need for full interoperability in m-payments services, and called for open standardization to ensure flexibility for user who plan to change service provider (e.g. MNOs, banks).

In Europe, a payment-integration initiative was launched in 2002 called the Single Euro Payment Area (SEPA) to ensure interoperability across the EU zone. These actions included reducing the fragmentation in payments procedures and shifted toward a single domestic

market. SEPA generated several initiatives involving such cooperation among financial intuitions, MNOs and payment providers to develop the m- payment contactless application. However, despite this diverse initiative, interoperability within the m- payment area is yet to be fully realized (Gannamaneni et al., 2015).Consequently, this study reviews the concepts of interoperability in the context of the m- payments service, its benefits, and describes the related challenges that platform providers face in achieving interoperability to develop m- payment platforms.

2. Concept of interoperability

On the whole, interoperability is the ability of multiple-systems, elements, components, units to exchange information and communicate to operate efficiently and provide valuable functions, and achieve at different levels (Breitfelder and Messina, 2000; Geraci et al., 1991; Pub, 2001).

Achieving interoperability requires determination of four levels to recognize interoperability in a broad way (Morris et al., 2004a; Kasunic et al., 2004; Chen et al., 2008a). This study proposes a framework that starts from levels of interoperability before introducing m-payment context to the framework as influences factors. There are four primary levels of interoperability:

2.1. Organizational interoperability is associated with the ability of organizations to exchange and transfer meaningful data (information) through effective communication and characterized by the diversity of information systems of different types of infrastructure. To achieve organization interoperability requires interoperability at the semantic, technical, syntactic levels (Rezaei et al., 2014 a; Lewis et al., 2008).

2.2. Technical interoperability realized by using a communication protocol for the direct exchange of services or data between platforms, system, components that need a protocol to operate (Novakouski and Lewis, 2012; Van der Veer and Wiles, 2008). Technical interoperability is always applied in hardware/software platforms, systems or components (Kosanke, 2006).Technical interoperability creates harmony between services and users.

2.3. Semantic interoperability is the ability to understand clearly the meaning of exchanged information, thus automatically interpreting the meaning of data between two or more systems. To realize semantic interoperability requires protocols or references models between the systems. Semantic interoperability is relative to humans rather than to computers and machines (Guijarro, 2009; Van der Veer and Wiles, 2008).

2.4. Syntactic interoperability is indicating the ability to exchange data between systems or service using standard data formats or communication protocols such as syntax and encoding (Van der Veer and Wiles, 2008).

Rezaei and Shams (2008b) state that interoperability is a multidimensional concept that can be investigated via different aspects and approached from different directions as well. Therefore, it is important to study interoperability framework covering all the concepts, levels, and perspectives before interoperability can be achieved and realized (Kajan, 2011; Chen, 2009).

3. Methods

This study adopted the literature review method to review and analyses the articles that related to interoperability in the mobile payments. We used the Social Sciences Citation Index (SSCI) of Web of Science Core Collection (WOS) and Scopus for the literature search. We have limited the search to the 2000 – 2014, so as to cover most relevant and contemporary journal publications and conference publications. This step was made because subject under the review is contemporary, and the majority of writings are not yet published in academic journals. For the first step, we have identified a combination of keywords as follows: (“mobile payment*”) AND (“interop*”). These keywords have been searched under the option topic that includes title, abstract and keywords search, which has yielded 136 publications. In the second step; we have assessed each publication for its relevance to the interoperability and mobile payments, and this has resulted in 68 publications. We have assessed the full texts of the relevance to the interoperability concept, benefits and barriers also interoperability in mobile payments. Finally, we included of 24 publications for the analysis.

4. Results and discussion

To understand interoperability in an m-payment services context we propose a framework from the interoperability level to map the benefits and barriers of interoperability.

4.1. Interoperability Benefits

4.1.1 .Reduce cost

Infrastructure costs are, one of the main challenges facing m-payment service providers while take off and developing their service. The frame cost for infrastructure is expensive; however, sharing the interoperability infrastructure by creating platforms would reduce the costs for all providers (Goeke and Pousttchi, 2010; Lai and Chuah, 2010). M-payment services could be grounded on the current infrastructure provided by banks; MNOs and payment cards (Harrison et al., 2014).However, these existing infrastructures often bar new payment services providers from obtaining.

4.1.2. Process agreement

The application of organizational interoperability is an agreement by providers on how to perform once they have exchanged a transaction. In particular, the process focuses on the provider’s action as soon as the information exchange has occurred (Lam et al., 2003). To accomplish process agreement, all providers should agree in advance on how to act when they receive a transaction (Isaac and Zeadally 2013). To achieve process agreements in m-payment service is complex (Dahlberg et al., 2015) and resulting obstacles need to be

addressed by service providers. This complexity often occurs when users need to deliver the same information to multiple services providers to authorize a single payment. Therefore, to achieve process agreements organization structures should be compatible and the platform should be clearly defined among all providers.

4.1.3. Data exchange

The main benefit for interoperability is key data exchange. Whereby data is exchanged conveniently a cross transaction systems and at any time (Kousaridas et al., 2018). In m-payment services, data (i.e. transaction details, or information of payer /payee) must be accessible to all transaction parties (payer– to payee and cardholder –to-merchant). Essay access between m-payment providers will improve services by effectively giving users the transaction they initiate effectively. Thus, the main aim of interoperability in m-payment services is to facilitate the transaction between providers and users, regardless of location (Dahlberg et al., 2008).

4.1.4. Meaning exchange

The application of semantic interoperability for m-payment service providers enhances understanding and realizing of data transferred between service providers while keeping the meaning of the data (Misra and Wickamasinghe, 2004). Thus, communication should occur with the same meaning while exchanging the data. The meaning exchange is a critical issue because all service providers should interpret the meaning in similar manner (Olsen et al., 2012). Therefore, interoperability will play a role in the improvement of m-payment services because it guarantees that the accurate meanings of transactions are transferred to payment systems. Hereafter, service providers can easily process a transaction between all cooperative service providers for authorizing m-payments (Olsen et al., 2012).

4.2 Barriers to interoperability in m-payment services

Interoperability for m-payment services has a significant impact on the ecosystem (Dahlberg et al., 2008, 2015). However, the absence of interoperability is one of the main issues being addressed. Accordingly, this section reviews the barriers hindering interoperability in m-payment services. Based on (Chen, 2006), we classify barriers into three categories: organizational, technological and conceptual.

4.2. 1.Organizational barriers

Organizational barriers refer to definitions of responsibility and authority, whereby interoperability can be incompatible. These barriers can be addressed as human or technological elements that are related to organization behaviours which act as hindrances. MNOs and banks have a challenge to find a shared view of how to realize m- payment services; this challenge hinders the creation and interoperability of business models that fulfil all the providers demands (Gannamaneni et al., 2015). In many cases, there a conflict in sharing and cost models, also the lack of cooperation between banks and MNOs, the position of each provider remains highly challenging for interoperable m-payment services (Hedman

and Henningson, 2015). For instance, MNOs seek to control the business at the role of services security. Simultaneously banks are in the hunt to extend their range within the m-payment environment (Ondrus and Lyytinen, 2011; Gannamaneni et al., 2015).

4.2.2. Technological barriers

Technological barriers refer to the incompatibility of information technologies such as (platforms, infrastructure, and architecture). These barriers concern standards for processing, storing, presenting, exchanging, and the ability to communicate data over software or computers. Many technological and digitalization hamper the development of mobile payments services (Hedman and Henningson, 2012). Consumers may not own a proper device for proximity payments. Merchants have to install new payment terminals in most cases (Mallat al., 2009). As initiatives do not use standardized technology, users are reluctant to invest in a platform which might not be interoperable with existing payment platforms (Mallat al., 2009). There is a need to involve a trusted third-party digital signature to allow a degree of security, and simultaneously this makes the token easily interoperable (De et al., 2015).

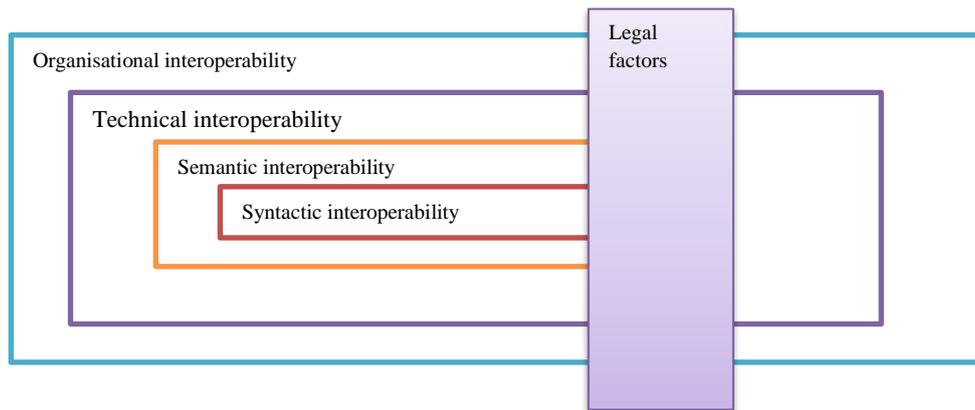
4.2.3 Conceptual barriers

Conceptual barriers refer to the semantic and syntactic differences of information exchanges. These barriers concern modelling at an extraordinary level of abstraction (i.e., company models of the enterprise) and at, the programming level, such as for semantic models. The lacks of semantic and syntactic interoperability means users are unwilling to trust a platform that provides such services (Cheng and Huang, 2013; Olsen et al., 2012; Hassinen et al., 2008).

5. Directive and legal issues as influencing factors

To realize valuable m-payment service is complex because the ecosystem involves several providers that deal with regulations (Zmijewska and Lawrence, 2005). We propose adding regulation as an effective factor, although we realized this factor is not equitable because it applies to virtually any m-payment ecosystem. For example, regulation can offer secure and effective m-payment services (Au and Kauffman, 2008). This is an opportunity for governments to improve payment services. From a service provider's perspective, these factors turn into a critical aspect of the interoperability dilemma, and m-payment initiatives must realize these factors. Therefore, to achieve any of interoperability levels requires resolutions to accommodate of regulations as shown in the proposed interoperability framework in Figure 1.

Fig 1 Basic concepts of m-payment interoperability



6. The way forward

The accomplishment of an entirely interoperable m-payment service is a complicated mission that is thwarted by several barriers. However, the following resolutions can be adjusted to realize full interoperability in m-payments.

6.1. Flexible regulatory framework

To realize full interoperability, requires implementation of regulatory contexts that concern users' needs and financial stability (Liu et al., 2015). Various factors affect this context such as market competition and existing regulations. The lack of integration among payment providers is not because of a lack of cooperation between them (European Commission, 2012). Banks have assumed that competition regulations are incompatible with SEPA's interoperability procedures. Moreover, payment service providers have claimed that the low levels of interoperability in retail payments is due to the huge differences in rules through national authorities. For instance, EU counties have different rules, settlements and clearing procedures, processing supplies and joint exchange agreements (European Commission, 2012). There is a need for more coordination to establish an interoperable service for users.

6.2. Cooperation is essential

In a European Commission report (2012), it was observed that establishing an m-payment service needs cooperation and high levels of coordination between key actors such as mobile network operators, banks, payers and payee service providers to facilitate the way payment to reaches all users . M-payments services offer banks the opportunity to protect the customer's current account and loan services and reducing the use of cash, thus reducing cash cost (Dennehy and Sammon, 2015). Similarly, m-payment as service is an opportunity for MNOs to recover the cost of investment in infrastructure by increasing data usage by users. In addition, cooperation generates new revenue streams by expanding into new services based on users' needs and experiences (Dennehy and Sammon, 2015).

However, these providers may cause competition that clogs the development of m- payment. For instance, MNOs and banks both have market power and they might attempt to control the

m-payment, thus leading to competition and a fragmented market (Mallat, 2007; Hedman and Henningson, 2012). Subsequently, the interoperability of m-payment services is often not merely conditioned on technology interoperability, but is also dependent on innovative cooperation among different services providers (Gannamanen et al., 2015). We identify this as the reason it is hard for a sole provider to develop and deliver a ubiquitous m-payment service.

6.3. Technology, security and architecture

Security procedures should be considered as an important element when to establish an interoperable m-payment services thus the possibility reach critical mass (Dahlberg et al., 2007; Pousttchi, 2003). Security is important because it has a role in the improvement of message protocols; devices, software, and secure elements (Ondrus et al. 2009). Therefore, m-providers should consider what security and technological mechanisms fit the different sorts of mobile payment services. Security strongly influences users when adopting m-payments (Dahlberg et al., 2008; Zmijewska et al. 2004). The technology and security for an interoperable platform is a challenge that can be solved if the m-payment providers cooperate to establish interoperability between the different systems (Ghezzi et al. 2010; Karnouskos and Fokus, 2004). Once this happens, it is essential to persuade merchants and users of the added value of m-payments for them.

7. Conclusion and remarks

Interoperability is contextual because it is distinguished by the communication between multiple systems, elements, components or units in a particular context (Bourrieres, 2006). Therefore, payment providers must consider both un-technological and technological characteristics of interoperability (Dahlberg et al., 2008; Ondrus et al., 2005). Interoperability can be investigated in any context over organizational, technical, semantic, and syntactic levels (Chen, 2006). Furthermore, the complexity of the directive and legal factor and technological factors of the m-payments context create interoperability challenges in the ecosystem.

The framework proposed in this paper highlights the variances between organizational, technical, semantic, and syntactic interoperability while capturing the crossing influence of directives and legal factor and technological factors as impacting features. The aim of this framework is to highlight how payment providers need to distinguish interoperability in the m-payment context by understanding the full dimensions. If m-payment service providers enhance the understanding of interoperability difficulties and influencing factors, we assume that more m-payment service solutions will succeed.

The main aim of interoperability in m-payment services is to enable the seamless exchange of transactions between payer and payee. However, interoperability within the context of m-payments services is yet to be realized. Consequently, the lack of interoperability between payment providers has led to a lack of technology standards and low added value for payer and payee (Gannamaneni et al., 2015). Accordingly, this study has reviewed the concepts and

attendant challenges of interoperability. The study also proposed resolutions to realizing interoperability in an m-payment context.

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