# Provision of Mobile Banking Services from an Actor-Network Perspective: Implications for Convergence and Standardization

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## Abstract

Continuous advancements in mobile technology allow mobile carriers and banks to offer mobile banking services. Such convergence of previously unrelated industries raises many complex issues. This paper examines the dynamics of competition and collaboration among mobile carriers, banks and other related parties for mobile banking in Korea during the burgeoning period of mobile banking in the early to mid-2000s. This period is when the idea of mobile banking was realised in practice and a variety of the parties involved criss-crossed each other to form a network of service provision. It presents an opportunity to examine the complex dynamics of network formation for convergence services and standardization. Since convergence and standardization is a process of merging and integrating multiple players into a new network or system, it is realized through the process of interactions among the players involved. Actor-network theory (ANT) is used as an interpretive lens to analyse this process. ANT helps analyse how actors form alliances and enrol other actors, including non-human actors (i.e. technology), in order to secure their interests. By analysing three specific actor networks that emerged during a formative period in Korea's mobile banking sector, this paper shows the significance of the processes involved in developing actor networks, and especially the role of non-human actors. Given the contemporary context of the ongoing smart phone wars, which shares many of the features of convergence and standards competition, the paper

serves as a timely reminder of the role played by key actors and the networks they create. The paper presents some implications for technology management in convergence- and standardisation-related areas.

Keywords: actor-network theory, mobile banking, convergence, alliance, standards wars, standardization

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## INTRODUCTION

Information and communication technologies (ICT) continuously create new types of markets and enable new patterns of industry dynamics. Industry dynamics refer to the way in which all the parties within an industry interact through competition and collaboration. This transformational power of ICT is not confined to an individual industry. Through convergence, ICT drives companies from different industries, which have never been related to one another previously, to compete and collaborate.

For instance, convergence has created a new battleground for the so called 'smart phones' that offer more advanced computing and connectivity than regular mobile phones. Here, Google with its Android platform and Apple with its iPhone and iPad on its own iOS platform are now competing fiercely for market share after beating players such as Microsoft and its smart phone partner, Nokia. Mobile phone manufacturers such as Samsung are now aligning themselves with multiple partners to offer as wide a range of products as possible. Convergence also creates new revenue generation opportunities for telecommunication companies as they switch from mere provision of infrastructure for other industries to full provision of Internet service provider capabilities and other value added services [1].

This is particularly true of mobile operators who are increasingly faced with decreasing ARPU (Average Revenue Per User), forcing them to seek new sources of revenue through data services where the ARPU would significantly increase [2]. Mobile banking is one such convergence service that brings together hitherto unconnected industries – banking and mobile operators – to offer value added services to their respective customers.

At the same time, the banking sector also needed to add a new service channel to their existing channels, so as not to be left behind in the fierce competition, and to acquire and retain increasingly technology-savvy customers. Banks perceived mobile banking as the next frontier for their services after Internet banking. Thanks to the development of mobile technology that

enables the delivery of banking services via mobile devices, mobile carriers and banks, which did not have a business relationship previously, have now become alliance partners and, at the same time, potential competitors as we will discuss later.

This paper examines the dynamics of competition and collaboration among mobile carriers, banks and other related parties for mobile banking in Korea during the burgeoning period of mobile banking in the early to mid 2000s. In particular it presents a snapshot of the evolving dynamics of competition and collaboration as the players interacted with each other to form a network of service provision. It presents an opportunity to examine the complex dynamics of network formation for convergence services and standardization since convergence and standardization is a process of merging and integrating multiple players into a new network, This paper revisits the formative period of mobile banking in Korea in the hope that exploring the past can teach us important lessons for the present and the future. Examining the dynamics of competition and collaboration in Korea's mobile banking sector in its early years helps us to better understand the complex dynamics at play in contemporary standards or platform wars in such technologies as smart phones and smart TVs.

To understand these dynamics, we needed to address several key questions. Who were the actors? How did they define competitors and collaborators? How did they actually form alliances and compete? Actor-network theory (ANT) is used in order for us to answer these questions. ANT is chosen because it helps analyze how actors form alliances and involve other actors, including non-human actors (i.e., technology), in order to strengthen such alliances and to secure their own interests. A deeper understanding of the convergence services can be gained by exploring the structure of the networks formed by the firms from different industries in order to provide a new type of service like mobile banking.

The remainder of the paper is organized as follows. The following section reviews studies of mobile banking and introduces ANT, with an emphasis on the two pivotal concepts

of the theory: inscription and translation. The next section describes the development of mobile banking in Korea, in which the main actors are identified, and an analysis of the dynamics of collaboration and competition among the actors through the four stages of translation is provided. A discussion follows of the theoretical and practical implications of the outcomes resulting from the analysis. Here we reflect on what implications we can draw for contemporary convergence and standards wars. The concluding section presents the contributions and limitations of the paper.

## LITERATURE REVIEW

### *Mobile banking*

Mobile banking is an extension of banking and financial services onto mobile networks and devices. Characteristics such as time and location independence as well as secured transactions through the use of a personal mobile phone to identify the account owner and to confirm the transaction [3] led to a rapid growth in mobile banking.

A common approach to the study of mobile banking focuses on consumer behaviour. Studies using this approach examine the diffusion patterns and demographic characteristics of mobile banking adopters [4], drivers and inhibitors [5], the perceived risks of mobile banking [6], attitudes of consumers [7], and the behavioural intention to use the service [8]. Among them, Luarn and Lin [8] suggest that customers' trust or lack thereof in the mobile banking system will affect the adoption of the system. Customers may have concerns that the mobile banking system is vulnerable to hackers or system intruders.

Partly in response to these trust concerns, there are many studies that investigate the security risks of mobile banking, which forms another stream of research on mobile banking [9-12].

These studies of mobile banking seem to be based on the simplistic assumption that once the service providers are able to deliver secured, user-friendly (in terms of functionalities, e.g. user interface), and consumer-satisfying services (as indicated in the consumer-focused studies mentioned above), then the mobile banking will be adopted by consumers. But the reality is more problematic. The value chain of mobile commerce is very complex and composed of many players who have their own vested interests. One source of this complexity is the nature of the mobile Internet functioning as a closed network[1]. While the Internet was an open network, the mobile Internet was a closed network before the advent of smart phones. While content providers on the Internet (in this context, banks) were not reliant on the network providers (e.g. Internet service providers) for their service provision, the content providers (e.g. banks) using mobile Internet were dependent on mobile operators because they could not reach their customers without passing through the mobile operators' network. Therefore banks needed mobile operators' cooperation for their mobile banking services provision. This allowed the mobile carriers to have control not only over the physical network, but also over the content carried over the network. Both banks and financial service companies had to find the most appropriate partners and enter into the most advantageous alliances if they were interested in utilizing the mobile banking service [13].

Recognising the importance of understanding the complexity of dealing with multiple players, Mallat et al. [3] identify the main players in the mobile banking value chain, examine their strengths and weaknesses, and offer three scenarios where banks and mobile operators make different configurations for different mobile service provisions. Although Mallat et al.

[1] The term 'closed system' describes the way mobile Internet operated before the advent of smart phones. In feature phones which were used before smart phones, access to a service/content (here, mobile banking) was menu-based due to the limited usability like small screens and input methods (e.g. selecting a number from the menu provided by the carrier). In this system, the mobile carriers could control what is provided through their network and decide what is displayed up front (e.g. number one in the menu) and what goes further below. Likewise content providers' access to customers was severely restricted by mobile carriers. This is the reason why this closed system is also called a 'walled garden'. The smart phone changed business ecosystems of many mobile businesses. It also transformed the ecosystem of mobile banking by allowing banks to develop their own apps to reach customers. It is an open system rather than a closed one.

[3] make a significant contribution by highlighting the roles played by different stakeholders, the analysis lacks the examination of how they, mainly the banks and mobile operators, interact with one another, and more specifically, how they compete on some occasions and collaborate on others in order to deliver mobile banking services. ANT is a useful theoretical perspective in analysing the dynamics of the stakeholders that interact in complex convergence environments such as mobile banking.

### *Actor-network theory*

ANT was developed in the field of sociology of science and technology [14-17, 34]. The theory originates in the belief that "the study of technology itself can be transformed into a sociological tool of analysis" ([17], p. 83). ANT views technology and related factors as a socially constructed system evolving through a complex dynamic of interactions [18]. This view offers an insight into how a technological artefact is deployed through the complex processes of interactions among the parties involved.

Inscription and translation are the pivotal concepts of ANT. Engineers who design, develop and diffuse a technical artefact embody, or 'inscribe' in ANT terminology, into the artefact the way it is used, their intention, their vision of the society and the world in which the artefact would fit best. In this sense, they become sociologists, or by Callon's [17] definition "engineer-sociologists." Why do drivers of vehicles respond in the same way to both a traffic policeman and a traffic light? It is because the traffic light is 'inscribed' with specific expectations with regard to how drivers should behave as decided by those that design and implement it (say, the traffic police department). This example highlights the key ANT feature of 'not distinguishing' between human and non-human actors.

Therefore, the technical aspects of the engineer's work are considered to be profoundly social. During the process of innovation it is both difficult and unnecessary to distinguish

between the technical aspects and the social aspects. When technology is accepted as a social artefact, into which engineers inscribe the society they want to see and materialise, the technology becomes an entity, or 'actor' in ANT terminology, with the same nature and characteristics of a human actor.

This feature of ANT's not distinguishing human and non-human actors is so essential that Latour writes in his book that "the precise role granted to non-humans" ([19], p. 10) is the first test in determining whether a study's claim to be using ANT is in fact valid. In other words, the non-human actors "have to be *actors*" ([19], p. 10), and are "presented in an account as *doing* something, that is, making some difference to a state of affairs …" ([19], p. 52).

ANT helps describe how actors form alliances, enrol other actors, and use non-human actors (artefacts) to strengthen such alliances and to secure their own interests [34]. This process is named 'translation,' which is defined as "the methods by which an actor enrols others" [16]. Translation typically consists of four stages when an actor-network is created [15]. The first stage of 'problematization' is initiated by a key player called 'the focal actor' at the centre of the network concerned. The focal actor defines the interests that others may share, establishes itself as indispensable, and sets the obligatory passage point through which all the actors in an actor-network must pass. Next, the 'interessement' occurs when the focal actor convinces the other actors by offering benefits or by threatening them with negative results for not enrolling. In the third stage of 'enrolment' the other actors accept the interests as defined by the focal actor. The final stage of translation is called 'mobilization,' which is when the focal actor uses a set of methods to ensure that the other actors act on their agreement and do not leave the network. To translate is to oblige an actor to consent to the passage defined by the focal actor [16]. Translation is not always successful, and often fails and this may occur at any stage. Callon [15] stated that each entity enlisted by the problematization could choose either to accept being integrated into the initial plan or to refuse the translation entirely.

Recently ANT has been much used in social studies of technology, particularly in information systems (IS) research. Since the pioneering works of Hanseth and Monteiro [20] and Walsham and Sahay [21], ANT has become increasingly popular as a powerful tool "to help us overcome the current poor understanding of the information technology (IT) artefact" [22]. Hanseth and Monteiro [20] investigated how standards in Norway's health information infrastructure inscribe behaviour among related actors, and suggest that the notion of inscription is a promising vehicle for understanding the complexity of the information infrastructure and standardization processes. Walsham and Sahay [21] analyzed the unsuccessful implementation of geographic information systems (GIS) for district-administration in India. According to their findings the GIS initiatives failed to create and maintain a stable actor-network with aligned interests. ANT has since been applied in various IS contexts and problems [23-34].

Our critical examination, however, reveals that many of them fail to pass the test set by Latour [19]. For example, Lee and Oh [34] examined China's attempt to set its own national, and also international, standard called WAPI (Wireless LAN Authentication and Privacy Infrastructure). They failed to illustrate how WAPI behaves as a non-human actor and how WAPI acts upon other human actors. Gao [33] also used ANT to analyse the process of strategy formulation and defined the telecom market as the non-human actor. However, there is no description of how it acts, plays a role, or influences the behaviour of other actors.

ANT is also useful in analyzing the success or failure of new technologies that are operating in markets like mobile banking, the focus of this paper. Faraj et al. [23] investigated the Web browser war between Netscape and Microsoft. Using the processes of inscribing, translating and framing, they demonstrated how actors acted and reacted to each other in the race for acquiring users for their own browser (Navigator and Internet Explorer). Holmstrom and Stalder [32] analysed the failure of electronic cash in Sweden. According to their findings,

the cash card failed because the target users, who were retailers in this case, did not see their interests being inscribed into the technology. Moreover, they perceived the technology as favouring the interests of the banks that initiated the project. They argue that for a socio-technical system to stabilise, it should reflect the interests of all the involved actors, particularly the users, by becoming a multi-purpose network.

When a new convergence service is created, a large number of actors from different industries are involved and they compete and collaborate in more complex ways than in service offerings within one industry. Standardization also involves alliances or networks of various stakeholders. Therefore, ANT offers a useful framework to understand convergence and standards wars.

## MOBILE BANKING IN KOREA[2]

Korean banks had successfully moved onto online banking by mid 2000s. This paper focuses on this early period. During this period, the penetration of online banking in Korea was well ahead of most developed countries, with the exception of Scandinavian countries [35]. Korea had the highest rate of broadband diffusion in the world in mid 2000s and this contributed to the growth of electronic commerce in general and in particular online banking [35, 36].

Banks were continually attempting to extend the capabilities of their services. As Internet banking edged further into the mainstream of banking services, financial institutions were leading the way into the next technological frontier, which was wireless access [37]. Due to the mobile Internet being a closed network before the advent of smart phones, as mentioned earlier, providing services on the mobile Internet required deep involvement with the mobile carriers.

[2] The description and ANT analysis of mobile banking in Korea in this and the following section was presented at the 26th International Conference on Information Systems (Oh and Lee, 2005).

Mobile phones were introduced to Korea in the mid 1980s, and the number of subscribers increased at a slow pace until the late 1990s. The rate began to skyrocket in 1998, and by the next year over half of the population had a mobile phone. It was in that year, 1999, that the first mobile banking service was launched. Since then the number of mobile phone users has increased at a steady rate. According to a recent report [38], over US$100 Billion worth of banking transactions were made over mobiles in 2010 in Korea.

As of 2004, there were three mobile carriers in Korea: SK Telecom (SKT), KTF (now merged with KT) and LG Telecom (now called LGU+). During the early 2000s, SKT was the leading firm in the market followed by KTF and LGT. For instance, in December 2004 SKT had a market share of approximately 51.3%, followed by KTF with 32.1% and LGT with 16.6% [57]. The proportion of the market share among the three companies remains almost the same until now.

SKT launched a service named 'NeMo' (Net Money) in 2001 as a means of conducting payments via mobile devices. Then the number of mobile phone subscribers stood around 29 million and most of them used primarily voice-related services. NeMo was the first time a mobile operator entered the financial sector. Firms in the financial sector, including banks, considered the NeMo service as a threat to their business domain [39]. In response to this rather sensitive reaction, SKT insisted that NeMo was not a financial service, but just another example of the numerous mobile Internet applications available. The first attempt to provide a mobile financial service by converging mobile and financial services seemed to drive the companies involved from the two sectors to clash with one another.

As the use of mobile technologies grew in both scope and intensity, banks began to see mobile carriers as potential competitors rather than as partners in regards to providing mobile banking services [40]. The intention of mobile carriers to enter into the financial sector became clear to the banks when NeMo was first launched. While collaboration between banks

(as a content provider) and mobile carriers (as a channel) is essential to the provision of mobile banking, they saw each other as immediate or potential competitors. Therefore, one can expect that the partnership between them will not be an easy-going process, but rather a very complex one. This poor relationship between the two prime stakeholders of mobile banking has been described as "one of mutual distrust" [41]. The underlying issue was who would lead the emerging market, and ultimately, gain control over customers and all related information. However, firms in different industries need to cooperate in order to provide a service in the mobile Internet market, in which they are all eager for control over customers [42]. Therefore there is inherent tension between value creation and appropriation of the value created by different partners [43, 44].

## ACTOR-NETWORK ANALYSIS

### *Mobile banking services*

Three phases were identified in the development of mobile banking in Korea in the early to mid 2000s on the basis of the underlying technology. We also identified five major actors in mobile banking during these phases: banks, mobile carriers, mobile phone manufacturers, customers and mobile banking technology. We found that there were four different actor-networks that had been created and destroyed: one in phase I, two in phase II, and one in phase III. While the major actors remained the same for the three phases of mobile banking services, their interests and problems had changed. In all, four actor-networks along with the four stages of translation were analysed.

In 2004, there were three mobile banking services in competition: MBank, KBank and BankOn. The largest mobile carrier (SKT) led MBank and the other two mobile banking services were both led by the largest bank (Kookmin Bank). The structure of the market was formed by competition and collaboration between mobile carriers, between banks, and between

mobile carriers and banks, which in turn had been shaped by the continuous advancement of related technologies.

These mobile banking services were only a temporary outcome of the ongoing competition and collaboration between mobile carriers and banks within the networks defined by the focal actor and the available technology.

***Phase I: The beginning of mobile banking***

Mobile banking services began in October of 1999. During the initial phase of mobile banking, customers were first connected to the mobile portal of each mobile carrier and then selected the bank that they wanted to make their transactions with. In order for this to work, a relatively simple arrangement was needed between the mobile carriers and the banks, where the mobile carriers would let the banks appear on the menu of the mobile portals (or sometimes let customers download the mobile banking programs to their phones) and the banks would open their mobile websites. Little cooperation was needed between the banks and the mobile carriers. Different models of mobile phones did not matter in this instance because banking applications ran on the built-in browsers or VMs (Virtual Machines for downloaded JAVA application programs) of mobile phones. During this phase, most of the marketed mobile phones already had the browsers and VMs installed for other data services. No additional changes were needed for the mobile phones to be used for mobile banking services. Therefore, mobile phone manufacturers did not have much room to play a role in providing these services.

The mobile carriers took the initiative during this phase. Due to the decreasing ARPU in voice communication [45], the mobile carriers had to acquire and retain more customers, and to also increase the use of the data services. In order to achieve this, they had to continually offer new services and applications. Mobile banking was considered to be the killer application that could attract more customers [13]. Additionally, as highlighted by the NeMo service

provided by SKT (see the previous section), mobile carriers had a hidden agenda of entering into the financial service market. Mobile banking services would enable mobile carriers to retain customers, and allow them to take the first step towards a new convergence market. If banks agreed to open their mobile websites, then it was a relatively simple process to add a banking service to the menu of existing mobile data services. Mobile carriers are identified as the focal actor during this first phase of mobile banking service, because of their role in initiating the process for mobile banking.

The problematization is the first stage of translation during which the focal actor seeks to become indispensable to the other actors by defining the nature of the problem(s) facing the other actors and then suggest that it could be resolved if the actors negotiated the 'obligatory passage point' [15]. The problematization started when mobile carriers noticed that the banks wanted to add the mobile channel to their existing ones such as online banking, telephone banking, and offline branches. Banks were anxious to begin offering mobile banking services ahead of their rivals in the sector. Although the banks might have known the intentions of the mobile carriers, they had to rely on the mobile carriers to provide their banking services on the mobile devices of their customers due to the closed nature of the then mobile Internet network. Customers were assumed to benefit from mobile banking as this offered them a further banking channel with the added convenience of being accessible anytime and anywhere.

The introduction of mobile banking services at this initial phase was relatively easy because the obligatory passage point (mobile websites for banking) defined by the mobile carriers was not difficult for the other actors to accept. Following the successful problematization, the mobile banking actor-network that was initiated by the mobile carriers moved towards the next step of translation, which is interessement. This is where the focal actor attempts to impose and stabilise the identity of the other actors [15]. Interessement confirms the validity of the problematization and the alliance that it implies. Then the actor-

network proceeds towards the enrolment when the other actors accept the interests defined by the focal actor [15].

However, this first mobile banking actor-network failed to persuade customers of its convenience and thereby to enrol them. First of all, it was not easy to use and it took a long time to complete a transaction because there were many required input items, such as passwords and account details. Long connection times meant higher costs due to the accrued usage fees from the mobile network. Similar to the case of electronic cash in Sweden [32], customers could not see their interests being inscribed in the offering during the first phase of mobile banking services. As a result, the translation terminated and these mobile banking services were not used much.

***Phase II: IC chip-based mobile banking and competing actor-networks***

Since the failed attempt of the mobile banking in the first phase, the IC (integrated circuit) chip technology had advanced and appeared in commercial applications, such as credit cards with an IC chip embedded. Mobile phone manufacturers were able to produce mobile phones with IC chips and were trying to find new applications that would take advantage of these chips. New applications were expected to increase the demand for new models. This is how the IC chips emerged as an actor that could shape both the structure and dynamics of mobile banking.

The IC chip-based mobile banking service was launched in September of 2003 by an alliance between LG Telecom, the smallest mobile carrier, and Kookmin Bank, the largest bank. The service was named BankOn. As the phone subscriber's bank account information was stored on the IC chip equipped within a mobile phone, the amount of packet traffic required for a transaction was significantly reduced and the connection time was remarkably shortened. By using the proprietary phones equipped with the IC chips, the mobile phone manufacturers played a bigger role than before. The services offered ranged from online services, like funds

transfer and MBPP (mobile bill presentment and payment), to offline services, such as using an ATM and paying public transportation fares [46]. Credit cards, stock trading and insurance were also added to the services offered. In order to promote BankOn, LG Telecom did not charge usage fees for its mobile network and Kookmin Bank exempted the fund transfer fees during an initial promotional period. They also offered the lowest fees even after the promotional period ended [46]. There were more than 120,000 subscribers to this service during the first two months, and there were over 150,000 mobile fund transfer transactions during the second month of service, which was nearly seven times more than that of the other mobile banking services [47].

However, the introduction of the IC chips raised some new critical issues among the actors. One of these issues was how to deal with financial services such as credit cards and micropayment services that were provided by the mobile carriers themselves in alliance with credit card companies, stock trading companies, and other types of companies. While LG Telecom, at that time, did not have its own financial service offerings, SKT and KTF promoted their financial services under the brand names of Moneta and K-merce, respectively. They wanted to make their financial service offerings linked to the IC-chip based mobile banking. However, the banks as collaborators of mobile banking did not want the mobile carriers to offer financial services as part of their mobile banking offering..

Other issues related to the fees that could be charged for information usage (treating mobile banking service as mobile content) and the sharing of mobile banking revenues between the carrier and the bank. Banks insisted that carriers should not impose an information usage fee for using the mobile banking services because the banking services were provided free of charge for both telephone and Internet banking. The banks thought that the mobile carriers should only take the revenues generated from providing the data communication, and no additional information usage fees were acceptable. However, the mobile carriers normally

collected information usage fees for mobile content in addition to the data communication fees, and they argued that the mobile banking service was valuable enough to charge separate usage fees. The two parties also had to determine an acceptable revenue sharing ratio.

The most controversial issue was who would issue the IC chips and who would control them. The IC chips contained information on customers and their account details, and therefore the issue of who had control over the chips, which enabled the owner to access the customer information directly, became crucial [48]. The banks and the mobile carriers fiercely disputed over this issue, and as a result two competing alliances, that is, actor-networks, were formed: the one called BankOn between Kookmin Bank and LG Telecom as mentioned above, and the other called MBank between SKT and other small banks.

In regards to the BankOn actor-network, Kookmin Bank emerged as the focal actor by taking the initiative of forming and leading the alliance. In order to launch its own mobile banking services, Kookmin Bank needed a mobile carrier that would allow the bank to control the customer and account information that is stored in the IC chip. The bank understood that LG Telecom urgently needed to gain new subscribers because it was the smallest mobile carrier. To LG Telecom, Kookmin Bank's huge customer base was attractive, because they could potentially become mobile phone subscribers. LG Telecom could also take advantage of the nation-wide branches of Kookmin Bank as sales channels. In this actor-network, the obligatory passage point defined by Kookmin Bank was the IC chip with its full control over customer information embedded within the chip. Other terms and conditions for this alliance, such as how the revenues from the mobile banking service were to be divided, were also agreed on and favoured Kookmin Bank. The revenue sharing agreement even required that Kookmin Bank receive a share of the revenue from the sale of BankOn phones from within their branches.

LG Telecom was enrolled in the BankOn actor-network by releasing direct access to the customer information contained within the IC chips, as well as other interests. As the

smallest mobile carrier, its most immediate concern was to acquire more customers. Mobile phone number portability was planned to be effective in January of 2004 in order to boost fair competition between mobile carriers. Mobile phone subscribers were allowed to switch only to LG Telecom without changing their numbers during the first six months of the plan, which was from January to June in the year 2004. This was a good opportunity for LG Telecom to take customers from the other two mobile carriers. The grace period that was endowed to LG Telecom, which was the weakest player, made the company rush for new differentiated services to attract even more customers.

Mobile phone makers developed several models of phones for BankOn services, expecting that the IC-based mobile banking would increase the sales of their new models. They were not concerned over who would control the content of the IC chips because they could easily adapt their machines to the changing requirements. BankOn succeeded in persuading and enrolling new customers because the customers that subscribed to the new mobile banking services perceived the quality to have improved when compared to Phase I.

The BankOn actor-network turned into mobilization, the final stage of translation, where the focal actor ensures that the other actors act on their agreement and do not leave the actor-network [15]. Customers could purchase a BankOn phone model and subscribe to LG Telecom at any Kookmin Bank branch in order to use BankOn services.

As Kookmin Bank had the largest number of both customers and branches in Korea, selling BankOn phones in the branches of Kookmin Bank was enough to threaten other mobile carriers and banks. As the mobile banking service targeted customers who wanted to access their bank account and make transactions at anytime and anywhere, it was based on deposit accounts supporting everyday transactions. Opening and maintaining a deposit account in Korea does not incur any costs. Those customers who wanted to subscribe to mobile banking services only needed to register for a free deposit account with Kookmin Bank. It is not certain

whether the number of deposit accounts of Kookmin Bank increased by introducing the mobile banking service with LG Telecom. However, Kookmin Bank could start better services earlier than other competitors and highlight its technological superiority to both account holders and potential customers.

However, Kookmin Bank failed to enrol SKT, the largest mobile operator, because they would not accept the obligatory passage point that was defined by the bank, which was inscribed with the bank's own interests. Prior to the formation of the BankOn alliance, Kookmin Bank and SKT had failed to reach agreement on the conflicting interests raised by the new IC-chip based mobile banking. As the largest mobile carrier, the position of SKT on these issues was completely different from that of LG Telecom. Given the number of subscribers and the huge network of sales agents they had built, SKT could not accept the offer made by Kookmin Bank, the offer being that a mobile carrier should be no more than a channel over which the content (i.e. account and transaction details) is carried. SKT had always been interested in entering the financial service market. To participate in the alliance led by Kookmin Bank meant to surrender the financial market that they had been so eager to enter into. In short, there was no reason for SKT to accept the technological configuration of the IC chips that Kookmin Bank had defined with the bank's interests inscribed.

To catch up with BankOn, SKT formed an alliance with other smaller banks and launched a new mobile banking service, called MBank. In this alliance, SKT was the focal actor. SKT originally wanted to adopt a different technological configuration from that of Kookmin Bank. In this new configuration, the chip would be virtually divided into two separate parts. The banks would control the part that contained account information and SKT would control the other part that maintained the information on Moneta, SKT's financial services. This configuration would prevent SKT from directly accessing bank account information. However, if the banks wanted to add new services using the installed IC chips, they would have

to first discuss these desired changes with SKT, which would make them in some way dependent on SKT for offering any new mobile banking services.

However, the technological configuration of MBank, which SKT had originally intended, could not be implemented. SKT had limited strategic options available to them when they first entered the mobile banking market since the competing actor-network, BankOn, was already successfully launched on the same technology platform, that is, the IC-chip based platform. The terms and conditions of MBank that SKT agreed upon with its participating banks could not significantly deviate from those in the BankOn actor-network, and therefore were in favour of the participating banks.

Table 1 summarises the competition between the two networks of mobile banking services that occurred in early 2004. Meanwhile, KTF, the second largest mobile operator, launched its own mobile banking brand KBank by subscribing to the Kookmin Bank alliance in March of 2004, on the same day that MBank was launched.

[Table 1]

***Phase III: A new actor-network***

In August of 2004, Kookmin Bank joined MBank, the mobile banking service led by SKT [49]. Although Kookmin Bank agreed to use the mobile banking brand owned by SKT, this did not mean that Kookmin Bank accepted the obligatory passage point originally defined by SKT. In fact, some commentators interpreted that SKT surrendered to the Koomin Bank alliance because it was very hard for SKT to enrol customers without Kookmin Bank as the bank had the largest number of account holders. The banks, including Kookmin Bank, were the winners of this game because they successfully prevented the mobile carriers, including SKT, from holding the rights to control customer information. Other terms and conditions, such as the distribution of the revenues, were also agreed on in favour of the participating banks. For example, the information usage fee was fixed at a very low level of approximately one dollar per month.

During this time it appeared that the competition between them had ended. However, translation was never completed [15]. The then mobile banking method, where the banks held the rights for IC Chips, still had problems from the perspective of the customers. If the banks controlled the installed IC chip, then the customers with accounts in several banks would need to have the same number of chips as the number of the banks whose mobile banking services they wanted to use. This would mean that the customer would have to change IC chips whenever they shifted banks between transactions. Clearly, this ‘one chip per bank’ idea supported by the banks was not beneficial to customers. The bank’s control over the IC chips in mobile phones also hampered the development of other useful applications that could be made possible by increasing the capacity of the IC chips. Therefore the chosen configuration of mobile banking services inscribed only the interests of the banks and their intention was not

to share customer information with the mobile carriers. Regardless of the intention of the banks, however, the potential of the technology (i.e. IC chips) enabled itself to be used for multiple purposes; the technology carried within itself the structure and pattern of competition and collaboration for the next round.

The mobile carriers continually questioned the current arrangements regarding the IC chips. Of the three mobile carriers, SKT and KTF, which together accounted for about 85% of all mobile phone users but lagged behind in providing IC chip-based mobile banking services, agreed not to accept the use of 'one chip per bank' in December of 2004 [50]. They also refused to collaborate with major transportation companies, such as Korea Railroad and Korea Highway Corporation, on their mobile transportation card projects because those firms insisted on using the one chip per company configuration [50].

Instead, both SKT and KTF planned to expedite the use of generic IC chips on which information on credit cards, bank accounts, and public transportation cards can be downloaded using OTA (over the air) technologies [50]. The memory size of an IC chip was to be upgraded, which would allow the chip to store over eleven applications [50]. SKT and KTF drove technology towards translating other actors while inscribing their own interests

The problematization of this actor-network gained more support with the advent of 3G WCDMA mobile phones. SKT and KTF decided to adopt the UICC (universal IC card) onto the WCDMA mobile phones [51]. UICC is an extended version of USIM (universal subscriber identity module), and it can add various applications such as financial services and payments. Mobile banking in the WCDMA environment makes the use of UICC inevitable because there is only one slot for IC chips in WCDMA phones. Until then, the subscriber information was not in the IC chip but stored in the mobile phone, and only the bank account information was in the IC chip. Therefore, the subscriber information and the bank account information were separately controlled, which provided the technical basis for mobile banking services. However,

in WCDMA mobile phones, both types of information would be stored in one IC chip, which supported an actor-network led by the mobile carriers, unless mobile phones with multiple slots for IC chips were developed. The advances of 3G WCDMA seemed to work in favour of the new actor-network. While the technology as an actor defined or confined the scope of issues, problems and even solutions, both SKT and KTF inscribed their interests with the new WCDMA phones.

## DISCUSSION

We have so far examined how mobile banking services have evolved through the lens of ANT. As mentioned in the review of ANT, the role of technology as non-human actors is a key aspect of an actor-network analysis. Here we discuss how technology has contributed to the evolution of mobile banking in Korea and played a significant role in the process by "making some difference to a state of affairs" [19]. We now reflect on the implications of the actor-network analysis of the Korean mobile banking case for convergence and standards wars.

### *Technology as an actor*

This paper shows how technology as an actor shaped the actor-networks of mobile banking services in the Korean context. Figure 1 shows the evolution of mobile banking services in Korea. In Phase I, the technology was under the control of mobile carriers because the services could be offered without involving mobile phone manufacturers. As such, their interests were fully inscribed. Banks, to some extent, shared the common interest in that they could add yet another channel for service delivery. As discussed above, however, customers found it inconvenient and they did not see their interests being inscribed.

During Phase II when the IC chip technology enabled enhanced mobile banking services, both customers and mobile phone producers saw their interests inscribed. At the same

time, however, the technology embedded within itself an inevitable clash between the banks and the mobile carriers surrounding the issue of who would have control over crucial customer information. Thus, the technology defined the shaping of the competing actor-networks in mobile banking.

In Phase III, the technology seemed to lean towards the mobile carriers who were able to offer customers convenience as well as other services beyond mobile banking.

[Figure 1]

iPhones were introduced in Korea in 2009, a few years later than in other markets. Smart phones transformed the ecosystem of mobile Internet completely. Triggered by the introduction of Apple's iPhone in Korea, business models and the relationship between the participants of mobile services, especially between mobile operator companies and content providers have changed considerably. In the new business ecosystem based on smart phones, mobile operators have less control over the development of applications (i.e. content) on smart phones than in the old business ecosystem of previous mobile phones where mobile operators could decide which content would be located at a higher level menu. Currently, mobile banking services using smart phones are provided with an app developed by each bank. Therefore, mobile operators' power over banks (i.e. application providers) and mobile banking has become significantly weaker. Banks do not have to rely on mobile operators for their mobile service provision. This also shows how technology influences the formation of a network, and how and to what extent inscription takes place among the actors involved.

**Reflections on contemporary standards and platform wars**

There are many similarities between the mobile banking dynamics that have been analysed in this paper and the contemporary standards and platform wars in the area of smart phones noted in the introduction to this paper. Both scenarios deal with rapidly changing technologies, innovations, and big corporations vying for market share. Both deal with alliances between firms and symbolise the tensions between value creation by multiple partners in a network and the appropriation of that value created by different partners in that network, with each trying to maximise its share of the pie. An ANT approach might suggest that Apple, having lost out to IBM a few decades ago in their battle for market share in the PC industry due to its refusal to align with other players and licence its technology unlike IBM (no effective actor-network and no translation despite having innovative technology), is now beginning to align with more players (for instance, iPhones are available on many mobile networks). Nokia's close alliance with Symbian, a technology that is not seen as best suited for the touch-interface that is common across smart phones, has meant that it has not created a successful actor network unlike competing players (even from other industries) such as Google, which is licensing its Android platform to many companies in the hope of radically improving market share (see [52-54]).

As Kenney and Pon [55] argue, the convergence and standards wars in relation to mobile Internet is currently still in its early stages. Competing alliances between mobile manufacturing companies, platform creators such as Google (Android), Microsoft (Windows Phone), RIM (Blackberry), HP/Palm (WebOS) and application writers present a complex and unstable scenario. Winners and losers in this competition may be determined by various factors such as the technology choices made by players, and by the "ecosystem" that a technological artefact help to create to back up their strategic choices [56]. The converging Internet industry presents some very real tensions between value creation and value capture by multiple partners.

It is here that ANT presents us with a powerful tool to analyse the evolving scenario not only in convergence but also in standards wars. Standards wars and standardization often revolve around building an alliance surrounding a particular technology which is to become a standard. ANT is a theory that helps analyse the ways in which actors form alliances and enrol other actors to strengthen such alliances surrounding a technology. Therefore there is a fit between the study of standardization and ANT [34]. This is well demonstrated by the case of mobile banking which is basically about alliance or network building and which shares the key characteristics of standards wars.

## CONCLUSION

Much is said about digital convergence, standards wars and platform competition; the transformational power of ICT enables companies from different industries to collaborate with one another in order to provide convergence services like mobile banking. We know that technology plays a key role in convergence services. However, little is known about the dynamic interplay between actors that help shape the convergence markets. By using ANT, this paper contributes towards a better understanding of how technology shapes both the pattern and structure of competition and collaboration among the actors that provide and consume mobile banking services. This is one of the contributions that the present study makes towards using ANT in order to better understand convergence and standard competition where various actors with different interests compete and collaborate, and form alliances or networks.

We have also highlighted the enrolment of customers in each of the three phases of mobile banking before the advent of smart phones. Initially, the mobile carriers' actor-network terminated because it failed to enrol customers. When the IC chip-based mobile banking was introduced, it worked in favour of the interests of the customers and finally succeeded in enrolling a significant number of customers. SKT joined the Kookmin Bank alliance because

it was attracted to the large customer base. Later on, SKT formed an alliance of the mobile carriers and sought to enrol customers by providing more customer-centric services. The competition between banks and mobile carriers surrounding mobile banking is basically about who can translate more customers effectively, and thereby capture most of the value created.

Another contribution is concerned with implications for business strategists working in convergence, standards and platform industries. From the case analysed, we draw three lessons which should be considered when making an alliance for the provision of convergence and platform services that not only apply to mobile banking, but also to other areas where convergence is becoming important. First, they need to observe what technology is currently being used, and what will likely come next. This will be one of the important factors that will aid the decision of who can become your alliance partner and who will become a potential competitor. Second, building an alliance with the right partners is the key to convergence services. Alliance partners exist not only within one's own industry, but also in other industries. Taking the leadership of an actor-network requires far more than merely securing the alliance within the boundary of ordinary activities. The leading actor needs to see beyond the horizon in order to influence others that may belong to other, even competing, actor-networks, and engage them in its own actor-network. Third, as in the second, competitors come not only from one's own industry, but from other industries as well. Competitors readily turn into collaborators, and vice versa, and both competitors and collaborators may arise from one's own industry or seemingly unrelated industries.

As seen above, by applying ANT this paper contributes to understanding not only the dynamics of mobile banking, but also that of standards wars and platform competition. However, it is not without limitations. Since the advent of smart phones, mobile banking has developed considerably, and the number of users and the number of transactions have increased at a very fast rate to become a major channel for bank transactions. Banks are not dependent

on mobile carriers any more for accessing their customers. This is another example where technology as an actor shifts the dynamics among the actors, causing a structural transformation in the related industries. Further research should follow to investigate and depict in detail how new technological developments such as smart phones change the dynamics among the actors in mobile banking. Actor-network theory is not well established yet for empirical investigation, though it is increasingly used in many social science disciplines. Applying ANT to new technologies and alliance building scenarios will help better understand the phenomena surrounding the technology under study, as well as contribute to developing ANT as an empirical lens.

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Table 1. BankOn and MBank (adapted from Jang [58])

| Brand | BankOn (KBank) | MBank |
|---|---|---|
| Focal Actor | Kookmin Bank ($2,230B) | SK Telecom (18M) |
| Actors | Nonghyup ($1,270B)<br>Kiup Bank ($690B)<br>Cheil Bank ($400B)<br><br>LG Telecom (4.8M)<br>KTF (10M) | Woori Bank ($1,070B)<br>Hana Bank ($870B)<br>Shinhan Bank ($800B)<br>Chohung Bank ($660B) |
| Launching date | 2003. 9 (2004. 3) | 2004. 3 |

For SKT, KTF, and LGT: the number of subscribers

For banks: the amount of assets

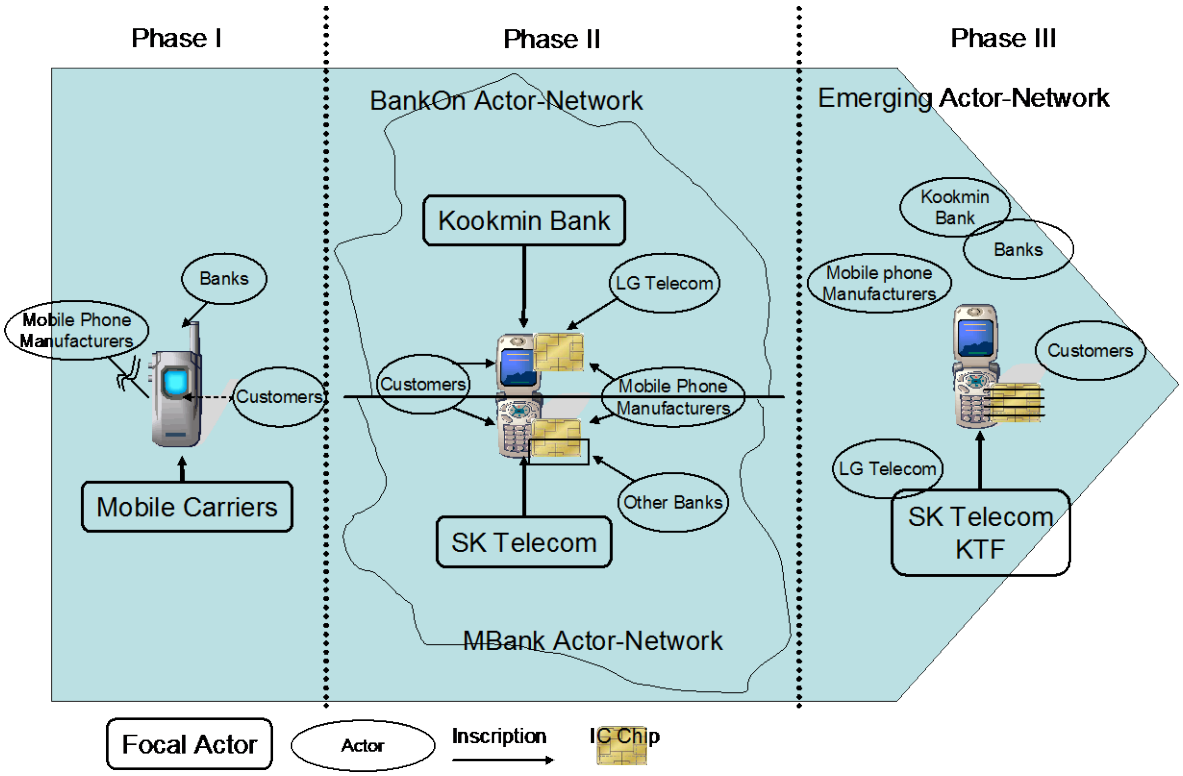


Figure 1. Actor-networks of mobile banking services in Korea