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How Technology Shapes the Actor-Network of Convergence Services: A Case of Mobile Banking

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Abstract

The continuous advancement of mobile technologies offers an opportunity for mobile carriers and banks to offer mobile banking services. However, such convergence of services from mobile carriers and banks raises many complex issues, particularly because it requires alliances among the actors who have different and sometimes conflicting interests. Using the mobile banking sector in Korea, this paper examines how the alliances between mobile carriers, banks, and other related parties are formed, and analyzes how technology affects competition and collaboration among them when a new convergence service is created by two, previously unrelated industries, in this case, by banks and mobile carriers. In so doing, we use the actor–network theory (ANT). As ANT helps analyze how actors form alliances and enroll other actors including nonhuman actors (i.e., technology) to secure their interests through the use of the technology, there is a fit between ANT and the emergence of new, converged services. This paper shows that it is technology that shapes the actor–network of convergence services, and that competition between banks and mobile carriers in mobile banking is about how to inscribe their interests in a given technology and thereby who can translate customers into their own network.

Keywords: Actor–network theory, mobile banking, convergence

Introduction

Information and communication technologies (ICT) continuously create new types of markets and enable new patterns of industry dynamics. The latter refers to the way in which all of the parties within an industry interact, that is, compete and collaborate, over the value chain. This transformational power of ICT is not confined to an individual industry. Through convergence, ICTs cause companies from different industries, which have never had a relationship, to compete and collaborate.

A recent example comes from mobile banking. Mobile carriers, facing the decreasing voice ARPU (average revenue per user), seek a new source of revenue in data services where ARPU is significantly increasing (McClelland 2004). They see a potential in mobile banking for generating revenue, gaining and retaining customers. Banks also need to add a new service channel to existing channels not to lag behind in fierce competition and to acquire and retain increasingly technology-savvy customers. For banks, mobile banking is the next sequence after Internet banking. Thanks to the development of mobile technology which enables the delivery of banking services via mobile devices, mobile carrier and banks, which formerly did not have a business relationship, have now become both competitors and alliance partners.

This paper examines how these alliances are formed and compete. To provide mobile banking services, many players/stakeholders (or actors, according to actor–network theory) across industries are involved and the unfolding processes are complex. The pattern of interactions and the dynamics among them that surround mobile banking services are key aspects of the questions we aim to explore in this paper. That is, who are the actors, how do they make alliances with each other, and how do they compete against each other? Another aspect is the role of technology in this process of shaping alliance and competition. That

is, how does technology define and/or confine the way banks, mobile carriers, and other related parties compete and collaborate to provide a new convergence service such as mobile banking? To answer these questions, we use the actor–network theory (ANT). ANT is chosen because it helps analyze how actors form alliances and involve other actors including nonhuman actors (i.e., technology) to strengthen such alliances and to secure their interests through the use of the technology. Through the lens of ANT, we investigate mobile banking, where mobile carriers and banks collaborate and compete in complex ways. By understanding the structure of the networks formed by the firms from (often completely) different industries to provide a new service (which we call *convergence services*), we can gain a deeper understanding of the structure and dynamics of unforeseen convergence services.

The remainder of the paper is organized as follows. The following section presents the actor–network theory, focusing on inscription and translation, two pivotal concepts of ANT. A section on methodology follows. The subsequent section describes the development of mobile banking in Korea. Here we identify the main actors in the mobile banking sector. We then analyze and discuss the dynamics of collaboration and competition among the actors through the four stages of translation. The concluding section presents contributions and limitations of the paper.

Actor–Network Theory

ANT was developed in the sociology of science and technology (Callon 1986a, 1986b, 1987; Callon and Latour 1981). It originates in a belief that "the study of technology itself can be transformed into a sociological tool of analysis" (Callon 1987, p. 83). Inscription and translation are the pivotal concepts that constitute ANT. Engineers who design, develop and diffuse a technical artefact embody (*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 best fits. In this sense, they become sociologists, or in Callon's word, *engineer-sociologists*. The technical aspects of the engineer's work are profoundly social. Therefore, it is hard to distinguish between the technical and the social during the process of innovation. When we accept that the technical is social, an artefact, on which engineers inscribe the social which they want to see and realize, becomes an entity or, in the ANT terminology, an *actor* with the same nature and characteristics as a human actor. The distinctiveness of ANT is that it does not distinguish between human and nonhuman actors.

ANT helps describe how actors form alliances, enrol other actors, and use nonhuman actors (artefacts) to strengthen such alliances and to secure their interests. This process, called *translation*, is defined as "the methods by which an actor enrols others" (Callon 1986a, p. xvii). Translation, when an actor–network is created, consists of four stages (Callon 1986b). In the first stage, *problematization*, the focal actor defines interests that others may share, establishes itself as indispensable, and sets the obligatory passage point through which all of the actors in an actor–network must pass. Then comes *interessement*, where the focal actor convinces other actors by offering benefits or threatening with negative results of not enrolling. In the third stage, *enrolment*, other actors accept the interests as defined by the focal actor. In the final stage of translation, *mobilization*, 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 (Callon 1986a). Translation is not always successful, but often fails and can halt at any stage. Callon (1986b) stated that each entity enlisted by the problematization could choose to submit to being integrated into the initial plan or, inversely, refuse the translation.

Since the pioneering works of Hanseth and Monteiro (1997) and Walsham and Sahay (1999), ANT has been gaining attention from a section of the informaiton systems research community and becoming increasingly popular as a powerful tool "to help us overcome the current poor understanding of the information technology (IT) artefact" (Hanseth et al. 2004). Hanseth and Monteiro investigate how standards in a health information infrastructure in Norway inscribe behavior among related actors, and suggest that the notion of inscriptions is a promising vehicle for understanding the complexity of information infrastructure and standardization processes. Walsham and Sahay analyzed the unsuccessful implementation of GIS for district-administration in India. In their study, the GIS initiatives failed to create and maintain a stable actor–network with aligned interests. The purpose of Walsham and Sahay's work was to establish ANT as one of the intensive research methods in IS research. ANT has since been applied in various IS contexts and problems (Adams and Berg 2004; Allen 2004; Atkinson 2002; Atkinson and Stergioulas 2004; Faraj et al. 2004; Frohmann 1995; Holmstrom and Stalder 2001; Klischewski 2001; Linde et al. 2003; Mahring et al. 2004).

Among that group of studies, two are worth noting in that they deal with actor–networks of new technologies operating in markets. Faraj et al. (2004) investigated the Web browser war between Netscape and Microsoft. Using three processes of inscribing, translating, and framing, they demonstrated how actors acted and reacted to each other in the race of acquiring users for their own browser (Navigator and Internet Explorer). Holmstrom and Stalder (2001) analyzed the failure of the introduction of electronic

cash in Sweden. According to them, the cash card failed because target users (here retailers) did not see their interests being inscribed and it seemed to work only for the interests of the banks that initiated the project. Therefore, for a socio-technical system to stabilize, it should reflect the interests of all of the involved actors, particularly users, by becoming a multi-purpose network.

When a new service is created and offered by the convergence of actors including technologies and firms operating in different industries, a larger number of actors are involved and they compete and collaborate in more complex ways. Therefore, ANT offers a useful framework to understand convergence services.

Methods

For this study, we collected data from media and some archival sources (McCulloch 2004). We searched articles using a keyword, *mobile banking* from databases of three newspapers published in Korea (one broadsheet, one business, and one English-language) by setting the search period from October, 1999, when Hanmi Bank started mobile banking services for the first time in Korea. Each of the newspapers selected is the major paper in its sector. We can expect that most of the factual data of significance will be retrieved by searching through these three newspapers. The databases were accessed on the web pages of each newspaper.

The three databases returned 214, 298, and 47 results respectively. The first author screened the results and eliminated some articles because there were many duplicates. For example, the same content was dealt with in articles in all three newspapers. In such cases, we kept the most detailed article and eliminated the other two. Even then, there were some cases where several different articles in one newspaper dealt with the same event. Also eliminated were articles that were not related to mobile banking services in Korea. For example, there were feature articles that reported ICT advancements in a futuristic tone, giving examples of mobile banking. This screening left 115 articles for analysis.

While reading these articles, we identified three phases in the development of mobile banking in Korea. These phases are characterized by different technologies. We also identified five major actors in mobile banking: banks, mobile carriers, mobile phone manufacturers, customers, and technologies. We also found that four different actor–networks had been created and disappeared: one in phase I, two in phase II, and an emerging one in phase III. While the major actors remained the same for the three phases of mobile banking services, their interests and problems changed. In this paper, we analyze the four actor–networks along with the four stages of translation.

Banks and Mobile Carriers in Korea

Korean banks have successfully moved to online banking platforms. The penetration of online banking in Korea is well ahead of most developed countries with the exception of Scandinavian countries (Lee, O'Keefe, and Yun 2003). Both the supply and demand sides of banking services made it easy for banks to provide Internet-based online banking services in Korea. Before the advent of Internet banking, banks had long invested in information technologies and the operation of banks was mostly accomplished electronically, with successful experience developing systems such as ATM (automatic teller machine) and phone banking. Experienced users of these technologies smoothly moved into Internet banking. The number of Internet users, particularly broadband subscribers, obviously helped this transition. Korea has the highest rate of broadband diffusion in the world and it has contributed to the growth of electronic commerce in general and online banking in particular (Lee, Oh, and Shim 2005; Lee, O'Keefe, and Yun 2003). As shown in Table 1, the number of Internet banking users has grown at a tremendous speed along with the growth of the broadband Internet subscribers.

Table 1. Number of Internet Banking Users in Korea (Adapted from MIC 2004)

Year	Number of Users	Growth Rate	Broadband Subscribers	Growth Rate
1999	1,230		434	
2000	4,090	232.5%	4,151	856.5%
2001	11,310	176.5%	8,419	102.8%
2002	17,710	56.6%	10,466	24.3%
2003	22,754	22.2%	11,292	7.9%

Table 2. Market Share of Mobile Carriers as of December 2004 (Adapted from MIC 2005)		
Mobile Carriers	**Subscribers**	**Market Share**
SKT	18,783,338	51.3%
KTF	11,728,932	32.1%
LGT	6,073,782	16.6%
Total	36,586,052	100.0%

Banks are continually attempting to extend the capabilities of their services. As Internet banking edges further into the mainstream of banking services, financial institutions are already leading the way into the next technological frontier: wireless access (Hoffman 2001). In this course of action, they have to deal with mobile network providers. Unlike Internet-based online banking, where Internet service providers play a minor role, providing services on the mobile Internet needs deep involvement by mobile carriers to enable the banking services to be accessible through mobile devices.

There are three mobile carriers in Korea: SK Telecom, KTF, and LG Telecom. From the beginning, SK Telecom has been the leading firm in the market with a market share of around 50 percent. SK Telecom has recognized the potential of its stable and large customer base and has been attempting to enter the financial sector where it can take advantage of its almost 19 million subscribers.

In the mobile payment area, for example, it launched a service named "NeMo" (Net Money) in 2001. It was the first time a mobile operator entered the financial sector. Firms in the financial sector including banks considered the NeMo service as an invasion by an outsider into their business domain (Kim 2003). In defense, SK Telecom insisted that NeMo was not a financial service, but just another example of the numerous mobile Internet applications. The first attempt to provide a mobile financial service by converging mobile and financial services seemed to cause companies in the two sectors to clash. The underlying issue was who would lead the emerging market, and ultimately, who would gain control over customers and customer information, as we will see later.

As the use of mobile technologies grew both in scope and intensity, banks began to see mobile carriers as potential competitors rather than as partners for mobile banking services. For banks, NeMo is clear evidence of mobile carriers' intention to enter the financial sector. While collaboration between banks (as a content provider) and mobile carriers (as a channel) is essential to the provision of mobile banking, they see each other as immediate or potential competitors. Therefore, we can expect that the partnership between them will not be an easy-going process, but a very complex one. The unfavorable relationship between two big stakeholders of mobile banking is described as one of mutual distrust in a study of German mobile banking (DeZoysa 2001). However, firms in different industries need to cooperate to provide a service in the mobile Internet market, all of which are eager for control over customers (Donegan 2000).

In Korea, there are currently three mobile banking services: MBank, KBank, and BankOn. While the first one is led by the biggest mobile carrier, the latter two are led by the biggest bank. Although they provide similar services to their customers, they have followed different paths from the beginning. The current structure of the market has been formed by competition and collaboration between mobile carriers, between banks, and between mobile carriers and banks, which in turn was shaped by the continuous advancement of related technologies. These mobile banking services (in other words, alliances) are only a temporary outcome of ongoing competition and collaboration between mobile carriers and banks within the networks defined by the focal actor and the technology. In the following section, we will show how alliances were formed surrounding the emergence of convergence services, here mobile banking in Korea, through the lens of ANT.

Analysis of Mobile Banking Actor–Networks in Korea

By the underlying technology, we can distinguish three phases in the development of mobile banking in Korea. In this section, we analyze each phase using ANT. We identify five major actors involved in the provision of mobile banking services: banks, mobile carriers, mobile phone manufacturers, customers, and mobile banking technology.

The Initial Phase of Mobile Banking

The mobile banking services began in October 1999. At the initial phase of mobile banking, once customers were connected to the mobile portal of each mobile carrier, then they selected the bank they wanted to use and made a transaction. For this to work, a relatively simple arrangement was needed between mobile carriers and banks; mobile carriers let banks appear on the menu of the mobile portals (or sometimes let customers download the mobile banking programs to their phones) and banks opened mobile web sites. Little cooperation was needed between banks and mobile carriers. Different models of mobile phones did not matter here because banking applications ran on the built-in browsers or VMs (virtual machines for downloaded JAVA application programs) of mobile phones. At this phase, most of the marketed mobile phones already had the browsers and VMs installed for other data services and no additional functions of mobile phones were required for mobile banking services. Therefore, mobile phone manufacturers had a small role in providing the services.

At this phase, mobile carriers took the initiative. Due to the decreasing ARPU in voice communication (McClelland 2004), they had to acquire and retain more customers and make them use more data services. To achieve this, they had to continually offer new services and applications. The mobile banking service was considered to be a killer application which could attract more customers. Additionally, as shown in the NeMo service provided by SK Telecom, mobile carriers had a hidden agenda for entering the financial service market. It was expected that mobile banking service would enable them to retain customers as well as take a first step in a new convergence market. It was relatively simple to add a banking service to the existing menu of mobile data services if banks agreed to open their mobile web sites. For their initiative role, we identify mobile carriers as the focal actor of the first phase of mobile banking service.

The problematization is the first stage of translation during which the focal actor seeks to become indispensable to other actors by defining the nature of the problem(s) facing other actors and then suggesting that it would be resolved if the actors negotiated the *obligatory passage point* (Callon 1986b). The problematization started when mobile carriers noticed that banks wanted to add the mobile channel to their existing ones including online banking, telephone banking, and offline branches. All banks were concerned that they might lose their initiatives in mobile banking to rival banks unless they did something in this area. Although banks doubted the real intention of mobile carriers, they had to rely on mobile carriers for using the closed[1] mobile Internet network in order to provide their banking services to the customers' mobile devices. Mobile web sites, the technical basis of mobile banking at this phase, were relatively easy to develop and maintain. It was also assumed that customers would benefit from the mobile banking services because they would gain another channel and convenient access to bank services.

It was relatively easy to introduce this initial phase of mobile banking services because the obligatory passage point (mobile web sites for banking) defined by the mobile carriers was not difficult for other actors to accept. Following the successful problematization, the mobile banking actor–network initiated by mobile carriers moved toward the next step of translation, interessement, where the focal actor attempts to impose and stabilize the identity of the other actors (Callon 1986b). Interessement confirms the validity of the problematization and the alliance that it implies. The actor–network then proceeds to enrolment, where other actors accept the interests as defined by the focal actor (Callon 1986b).

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 too long to complete a transaction because there were many input items such as passwords and account details. Long connection time also meant high costs accrued from the usage fee of the mobile network. As noted in the case of electronic cash in Sweden, customers did not see their interests being inscribed in the offering of the first phase of mobile banking services. As a result, the translation terminated and these mobile banking services were not used much.

IC Chip-Based Mobile Banking: Two Competing Actor–Networks

Since the failed attempt of mobile banking in the first phase, IC (integrated circuit) chip technology had advanced and appeared in commercial applications such as smart cards and credit cards with IC chips. Mobile phone manufacturers were able to produce mobile phones with IC chips inserted, and active in finding applications to use the chips. It was expected that new applications would increase the demand for new models. In this way, IC chips emerged as an actor that could shape the structure and dynamics of mobile banking.

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[1]Unlike the wired Internet, mobile Internet was closed in that all the mobile Internet services had to be provided through the gateways of the three mobile carriers. This meant mobile carriers had full control over not only the physical network but also the contents carried over the network.

The IC chip-based mobile banking service was launched in September 2003 by an alliance between LG Telecom, the smallest mobile carrier, and Kookmin Bank, the largest bank. It was named BankOn. As the phone subscriber's bank account information was stored on the IC chip in a mobile phone, the amount of packet traffic required for a transaction was significantly reduced and the connection time was remarkably shortened. By using proprietary phones equipped with IC chips,[2] mobile phone manufacturers played a bigger role than before. The services offered range from online services like funds transfer and MBPP (mobile bill presentment and payment) to offline services such as using ATMs and paying public transportation fares (LG Telecom 2003). Credit cards, stock trading, and insurance are to be added to the service (LG Telecom 2003). To promote BankOn, LG Telecom decided not to charge the usage fees of mobile network and Kookmin Bank exempted the fund transfer fees for the promotional period. They also promised the lowest level of fees even after the promotional period (LG Telecom 2003). Subscribers to this service numbered more than 120,000 during the first 2 months, and the number of mobile fund transfer transactions reached over 150,000 in October which was 6 to 7 times more than that of other mobile banking services (Park 2003).

The introduction of IC chips raised some new critical issues among the actors, the most controversial being who would issue IC chips and who would control them. Because IC chips contain information on customers and their account details, it is crucial to keep control over chips, which gives the owner direct access to customers (Bank of Korea 2004). Banks and mobile carriers had fierce disputes on this issue, and two competing alliances, that is, actor–networks, were formed.

For the BankOn actor–network, Kookmin Bank emerged as the focal actor by taking the initiative of forming and leading the alliance. To launch its own mobile banking services, Kookmin Bank needed a mobile carrier that would allow the bank control over the customer and account information stored in an IC chip. The bank understood that LG Telecom, as the smallest mobile carrier, urgently needed to gain new subscribers. For LG Telecom, Kookmin Bank's huge customer base, which would possibly be transferred to mobile phone subscribers, looked attractive. LG Telecom could also take advantage of Kookmin Bank's nation-wide offline branches as its sales channels. In this actor–network, the obligatory passage point defined by Kookmin Bank was the IC chips with its full control embedded.

LG Telecom, by giving up direct access to the customer information in the IC chips, was enrolled in the BankOn actor–network. As the smallest mobile carrier, acquiring more customers was the most immediate concern. Mobile phone number portability, planned to become effective in January 2004, would boost fair competition between mobile carriers. According to the plan, during the first 6 months, from January to June 2004, mobile phone subscribers were allowed to switch only to LG Telecom without changing their numbers. This was a good opportunity for LG Telecom to churn customers out of the other two mobile carriers. This grace period endowed to LG Telecom, the weakest player, made the company rush for new differentiated services to attract customers.

Mobile phone makers developed several models of phones for BankOn services, expecting that IC-based mobile banking would increase the sales of their new models. It was not their concern who would control the contents of the IC chips; they could easily adapt machines to changing requirements. BankOn succeeded in persuading and enrolling customers, who subscribed to the new mobile banking services, quality of which was perceived as much improved compared to the initial phase.

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 (Callon 1986b). To use BankOn services, customers just pay a visit to any branch of Kookmin Bank, where they can purchase one of several models of BankOn phone and subscribe to LG Telecom.

However, Kookmin Bank's BankOn alliance failed to enrol SK Telecom, the largest mobile operator, which could not accept the obligatory passage point that was defined by Kookmin Bank and inscribed with the bank's interests. As the largest mobile carrier, SK Telecom's position was totally different from that of LG Telecom. Given the number of subscribers and the huge network of sales agents they had built, SK Telecom could not accept Kookmin Bank's offer that a mobile carrier should take part as no more than a channel over which contents (i.e., account and transaction details) are carried. As seen above, SK Telecom had long been interested in entering the financial service market. To participate in Kookmin Bank's BankOn alliance meant to give up the financial market they had been eager to enter. In short, there was no reason for SK Telecom to accept the technological configuration of IC chips that Kookmin Bank had defined.

[2]CDMA was the protocol used for mobile services in Korea. Thus mobile phones used in Korea were not equipped with an IC chip (e.g., Subscriber Identity Module Card) as found in GSM (Global System for Mobile Communication) phones.

Table 3. BankOn and Mbank (Adapted from Jang 2003)		
Brand	**BankOn (KBank)**	**MBank**
Focal Actor	Kookmin Bank ($2,230B)	SK Telecom (18M)
Actors	Nonghyup ($1,270B) Kiup Bank ($690B) Cheil Bank ($400B) LG Telecom (4.8M) KTF (10M)	Woori Bank ($1,070B) Hana Bank ($870B) Shinhan Bank ($800B) Chohung Bank ($660B)
Technology	One chip	Dual chip
Control on chips	Bank	Bank and mobile carrier
Launch date	September 2003 (March 2004)	March 2004

For SKT, KTF, and LGT: the number of subscribers
For banks: the amount of assets

To catch up with BankOn, SK Telecom formed an alliance with other smaller banks and launched new mobile banking services, called MBank. In this alliance, SK Telecom was the focal actor. SK Telecom adopted a different technological configuration from that of Kookmin Bank while using the same technology. In this configuration, called *dual chip mode*, the chip is virtually divided into two separate parts. Banks control one part, which contains account information; SK Telecom controls the other part, which keeps information on Moneta (developed from NeMo), its financial services. The technological configuration of MBank was much inscribed by the focal actor in that SK Telecom was able to provide its own financial service, Moneta, for new mobile banking subscribers. Although banks prevented SK Telecom from directly accessing the account information, if they wanted to add new services using the installed IC chips, they had to discuss it with SK Telecom, which made them in some ways dependent on SK Telecom for offering innovative mobile banking services. Participating banks of MBank were aware of the hidden agenda of SK Telecom. To compete with Kookmin Bank in mobile banking, however, they had to accept the dual chip mode, the obligatory passage point defined by SK Telecom, and enrol in the MBank alliance.

Table 3 summarizes the competition between the two networks of mobile banking services in early 2004. KTF, the second largest mobile operator, launched its own mobile banking brand, KBank, by subscribing to the Kookmin Bank alliance in March 2004, on the same day when MBank was launched.

Ongoing Conflicts: An Emerging Actor–Network

In August 2004, Kookmin Bank finally agreed to participate in MBank, a mobile banking service led by SK Telecom (Choi 2004). Although Kookmin Bank agreed to use the mobile banking brand of SK Telecom, that does not mean that Kookmin Bank accepted the obligatory passage point defined by SK Telecom. Actually the case was the opposite. It was interpreted by some commentators that SK Telecom surrendered to the Koomin Bank alliance because it was very hard for SK Telecom to enrol customers without the Kookmin Bank network, as Kookmin Bank had the largest number of account holders. Kookmin Bank was the winner of this game because it successfully prevented SK Telecom from holding the rights to control customer information. More importantly, Kookmin Bank can be accessed on any of the three mobile networks. It looks as if the competition between them was over. However, translation is a never completely accomplished (Callon 1986b).

The mobile banking method of BankOn and KBank, where banks hold the rights for IC chips, still has a problem from the customer perspective. If banks control the IC chip installed, customers who have accounts in several banks should have the same number of chips as the number of the banks whose mobile banking services they want to use. It means that they have to change IC chips whenever they shift banks for transactions. One chip per bank, which is supported by each bank, is not beneficial to customers. The bank's control over IC chips in mobile phones also hampers the development of other useful applications, which are made possible by the increasing capacity of IC chips. In the current configuration of BankOn and KBank are inscribed only banks' interests and intention not to share customer information with mobile carriers. However, the potential of the technology (i.e., IC chips) enables it to be used for multiple purposes. The technology carries with itself the structure and pattern of competition and collaboration in the next round.

Mobile carriers continually questioned the current arrangements regarding IC chips. Among the three mobile carriers, SK Telecom and KTF, which combined had about 85 percent of the mobile phone user market but lagged behind in providing IC chip-based mobile banking services, agreed not to accept one chip per bank in December 2004 (Kim 2005). They also refused to collaborate with major transportation companies such as Korea Railroad and Korea Highway Corporation for mobile transportation card projects because those firms insisted on the one chip per company configuration (Kim 2005).

Instead, SK Telecom and KTF planned to expedite the use of generic IC chips on which information on credit cards, bank accounts, and public transportation cards could be downloaded using OTA (over the air) technologies (Kim 2005). Also scheduled was an upgrade in the memory size of an IC chip so it could store more than 11 applications by February 2005 (Kim 2005). SK Telecom and KTF drove the technology to translate other actors while inscribing their interests. Although the plan has yet to go through the long translation process, it is likely that it will give birth to a new actor–network of mobile banking where two large mobile carriers emerge as the focal actor.

The problematization of this actor–network has gained more support with the advent of 3G WCDMA mobile phones. SK Telecom and KTF decided to adopt UICC (universal IC card) on the WCDMA mobile phones (Kang 2005). UICC is an extended version of USIM (universal subscriber identity module), and it can add various applications such as financial services and payments. Because there is only one slot for IC chips in WCDMA phones, mobile banking in the WCDMA environment makes the use of UICC inevitable. Until now, subscriber information was not in the IC chip but stored in the mobile phone, and only account information was stored in the IC chip. Therefore, subscriber information and account information could be separately controlled, which provided the technical basis for the BankOn actor–network. However, in WCDMA mobile phones, both types of information can be stored in one IC chip, which supports the mobile carrier led actor–network in mobile banking, unless mobile phones with two or more slots for IC chips are developed. It seems that the advanced technology of 3G WCDMA works in favor of the emerging actor–network. While the technology as an actor defines (or confines) the scope of issues, problems, and even solutions that will follow in the development of mobile banking, SK Telecom and KTF inscribe their interests in the new WCDMA phones.

In response to the emerging actor–network of SK Telecom and KTF, Kookmin Bank is attempting to protect its business domain and lead in mobile banking by taking more progressive and aggressive measures. Kookmin Bank seems to be interested in becoming an MVNO (mobile virtual network operator), which would enable it to conduct business using a hired bandwidth of an MNO (mobile network operator) (Kim 2004). If Kookmin Bank embarks on the MVNO business, it will vertically integrate mobile banking from a network infrastructure to a banking infrastructure. This will also influence future competition on mobile banking between mobile carriers and banks.

Figure 1 shows the evolution of the mobile banking service 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 shared interests to some extent in that they could add another channel for service delivery. As discussed above, however, customers found it inconvenient and did not see their interests inscribed. In phase II, IC chip technology enabled enhanced mobile banking services where customers and mobile phone producers saw their interests inscribed. At the same time, however, the technology embedded within itself an inevitable clash between banks and mobile carriers surrounding the issue of who would control customer information; the technology defined the shape of actor–networks in mobile banking. In phase III, the technology seemed to lean toward mobile carriers who can offer customers convenience as well as other services beyond mobile banking. There is only one arrow, from the two major mobile carriers, as we have yet to see how this emerging actor–network will be shaped.

Conclusion

In this study, we explored how actor–networks have been constructed surrounding mobile banking services, and shown how technology defines the structure of competition and collaboration among the actors. In the first phase of mobile banking, the definition of the obligatory passage point by mobile carriers was not difficult for other actors to accept. The intention or interests of the focal actor inscribed in the then mobile banking system were relatively neutral to all of the actors and mobile carriers succeeded in translating banks and mobile phone makers. However, it failed to translate customers at the interessement/enrolment stage, and this led two major actors, mobile carriers and banks, to find a better solution for customers.

Then IC chips appeared as an alternative, and IC-chip based mobile banking was introduced. Two actor–networks—one led by the largest mobile carrier and the other by the biggest retail bank—provided IC-chip based mobile banking services, which were

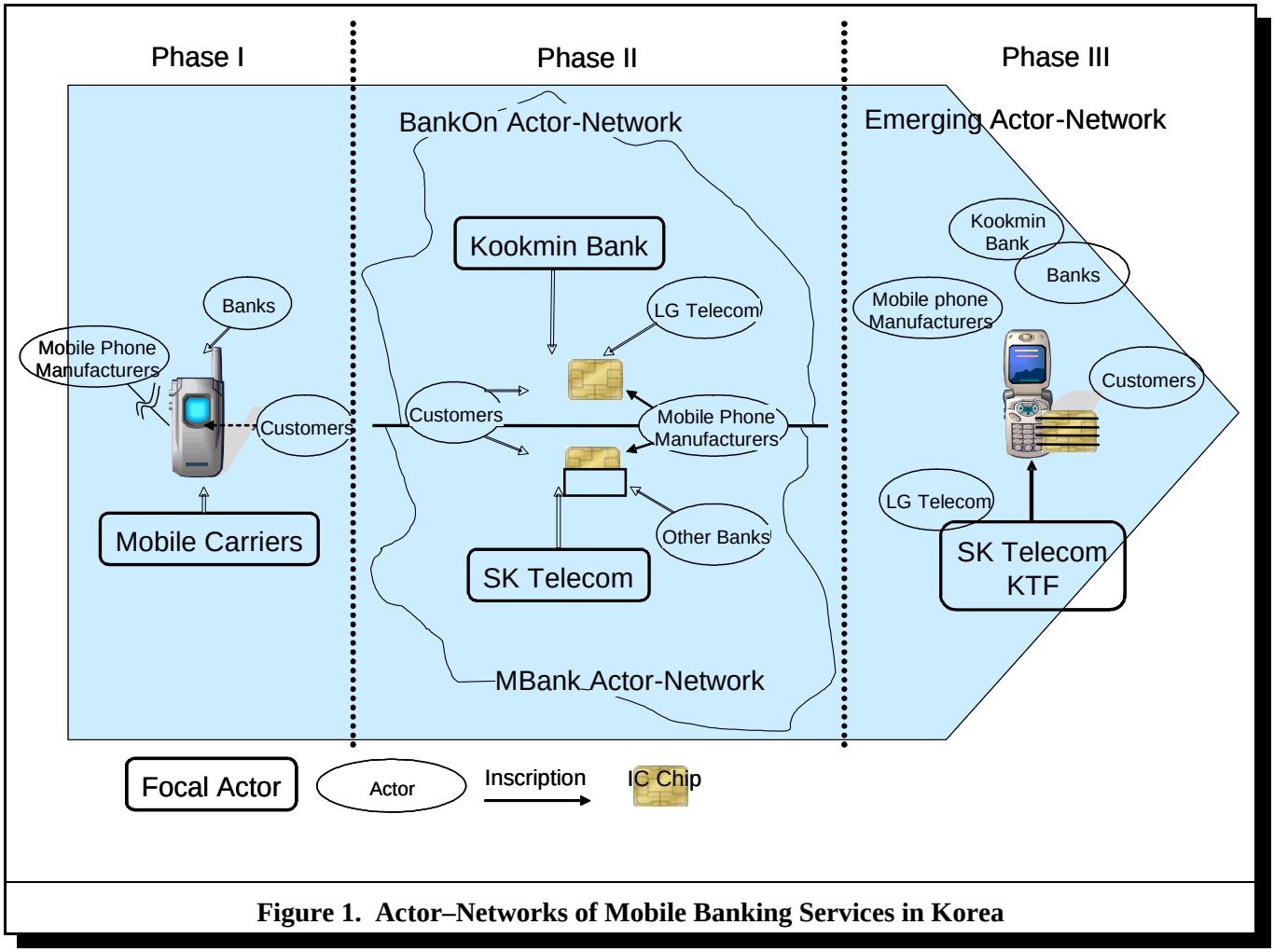

Figure 1. Actor–Networks of Mobile Banking Services in Korea

technically similar but differently inscribed. The focal actor in each actor–network inscribed its own interest into the IC chip. Both actor–networks, to some extent, succeeded in translating other actors, in particular customers, who had not been enrolled at the first phase of mobile banking.

SK Telecom, the leader of the MBank alliance, gave in to accept the obligatory passage point, which was technically called *one chip* and set by Kookmin Bank, the focal actor of the BankOn actor–network. The installed customer base of Kookmin Bank in retail banking could not be ignored by SK Telecom. However, translation never ends. The IC chip-based mobile banking method used by the Kookmin Bank alliance has a problem in that customers have to change chips whenever they need to access to other banks. Taking advantage of this problem, mobile carriers formed a new alliance with a solution in the name of better customer service. Although we have yet to see how the technology defines the actions of the involved actors and how it is inscribed by the focal actor, the WCDMA technical specification seems to favor this new alliance. Kookmin Bank is building a new actor–network against the mobile carriers' alliance.

Much is said about ICT and convergence; the transformational power of ICT enables companies from different industries to collaborate to provide convergence services like mobile banking. We know that technology plays a key role in converging services. However, little is known about how convergence markets are shaped. By using ANT, this paper reveals how technology shapes the pattern and structure of competition and collaboration among actors in providing and consuming these services. It is human actors who inscribe their interests onto a technological artefact. However, the technology also influences how and to what extent the inscription takes place. Currently, for example, mobile banking is implemented over mobile phone networks. There is a possibility that technological infrastructure will be shifted to wireless broadband (often called Wibro or WiMax) networks.

This shift may introduce new actors such as device (other than mobile phone) manufacturers and weaken the power of mobile carriers. The ways actors inscribe and strategies for translation will all change. In phase III, the capacity of IC chips to perform multiple applications is already influencing the balance between mobile carriers and banks, tilted towards mobile carriers who are willing to offer other applications that will help them enrol customers. This paper enhances our understanding the way convergence markets are formed.

We also highlight the enrolment of customers in each phase of mobile banking. Before IC chip-based mobile banking, the mobile carriers' actor–network terminated because it failed to enrol customers. When IC chip-based mobile banking was introduced, it coincided more with customers' interests and succeeded in enrolling customers. SK Telecom surrendered to the Koomin Bank alliance mainly due to the installed customer base. Recently, SK Telecom formed an alliance of mobile carriers and sought to enrol customers by providing more customer-centric services. The evolution of actor–networks surrounding mobile banking shows that more customer-centric services only translate customers. The competition between banks and mobile carriers surrounding mobile banking is, after all, about who can effectively translate customers.

Convergence services such as mobile banking, Internet TV, and DMB (digital multimedia broadcasting) continue to appear as ICTs develop. These emerging services generally require commitment from multiple actors of different industries, which means the need for some focal actors to translate other related actors. In the translation process, customers are likely to be excluded while a focal actor problematizes and resolves the conflict of interests between the actors associated with providing services. However, as can be seen from the experience of mobile banking in Korea, customers are enrolled only when they see their interests inscribed.

This study has some limitations regarding data. By relying on publicized secondary data only, this paper may be able to present interpreted intentions and interests of the actors. However, as the nature of the questions asked in this study is of strategic importance for those actors, it is not easy to find and reveal their intentions and interests from primary data sources like interviews. Although the collected data from publicized sources is limited, we can still tell how the actors behaved in forming the actor–network concerned, and understand the process of translation.

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