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Description	一般講演要旨

## Innovation in Services – the Case of B2B Mobile Services in Korea

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**Abstract**—This paper aims to investigate the dynamics of innovation in the Korean B2B mobile services. An analysis of 242 service products through statistical techniques was done to characterize B2B mobile services in Korea. As a result, service products were grouped into seven types based on the service characteristics: Mobile office/education solutions, network solutions, multimedia broadcast solutions, business analytical solutions, security and safety solutions, payment processing solutions and machine to machine (M2M) solutions for facility management. Then, we identify the key characteristics of those services, and find out which service characteristics lead to innovations and what type of service innovations pervade the B2B mobile services. This paper also conducts an empirical case study of Mobile Campus at two universities: UNIST and POSTECH. It stimulated discussion on innovation in mobile services and the different dynamics of innovations

**Index Terms**— Service innovation, Mobile service, B2B, Mobile Campus, Korea

### 1. INTRODUCTION

As mobile service and device development activities are increasingly intertwined, the distinction between manufacturing and service industries is becoming unclear in the mobile sector. The convergence trend of technologies and services which had developed separately in different industries has increased new business opportunities for mobile carriers. Within this background, it is necessary to work towards proposing a new service innovation model to reflect the dynamics of mobile service innovation by using the synthesis approach.

Mobile service users can be largely divided into two segments: individual users (hereinafter defined as B2C mobile service) and institutional or business users (hereinafter defined as B2B mobile service). Among the two, this paper focuses on the B2B mobile service because it is one of the most promising and growing service sectors. This paper will look at innovations from service-oriented as well as technological perspectives so that its approach fits the service innovation context from various aspects of the mobile service industry. Hence, the paper aims to understand the dynamics of service innovation and to identify main types of innovations in Korean B2B mobile services from the characteristics-based approach.

This paper is structured by seven sections. Section 2 provides a description of the paradigm shift in Korean

mobile service industry. Section 3 presents theoretical background and addresses the framework of the study. Section 4 explains data collection and research method. Subsequently, Section 5 describes the results of identifying the dynamic aspects of innovation in the Korean B2B mobile services. Section 6 presents service innovations in Mobile Campus. Section 7 provides conclusions and implications for future studies.

### 2. PARADIGM SHIFT FROM B2C-ORIENTED TO B2B-ORIENTED IN KOREAN MOBILE SERVICE INDUSTRY

During 2009-2010, the Korean mobile telecommunications industry experienced a significant change in the market, technology and regulation aspects. For instance, mobile regulations and domestic policy concerns directly affected the technological and market-related factors in Korea. Since regulations moved towards the openness policy, the domestic mobile sector obtained numerous opportunities to adopt and produce many innovative services and mobile devices.

Compared to individual customers, the institutional customers have more sophisticated needs and demands. It provided for mobile carriers to produce many B2B mobile solutions to meet the specific requirements of B2B customers in various industries. In addition, the trend of convergence between devices, services and technologies within and across industries not only offered a challenge to the mobile carriers but also offered a breakthrough for them to continuously develop new service products in the saturated B2C market. The technological characteristics (e.g. smartphone and its operating system) can expand the range of user participation in the development of new B2B mobile services. Consequently, the increasing business opportunities suggested mobile carriers to find a future growth engine in B2B. Various mobile solutions have emerged within and across industries, and consequently led to many service innovations in the Korean B2B mobile service market.

Those changes provided a basis for the transition of market focus from B2C-oriented to B2B-oriented market, and such transition from B2C to B2B mobile services offered a framework for using paradigm change as the conceptual criteria to demonstrate how the Korean mobile sector has experienced a radical change to create service innovations.

### 3. THEORETICAL BACKGROUND AND RESEARCH FRAMEWORK

#### 3.1. Characteristics-based approach to innovation

Lancaster (1966) observed that products can be described as a bundle of ‘service characteristics’ [1]. Lancaster’s insight is that consumers do not desire a product in itself but rather the particular bundle of service characteristics that it offers.

In accordance with the Lancasterian perspective, Gallouj (2002) argues that service characteristics are considered from a user’s point of view, and innovation can be defined as any change affecting one or more terms of these characteristics [2]. It is furthermore supported by prior studies studying the mobile service sector in that phone characteristics and services characteristics influenced the diffusion and innovation of mobile services [3][4][5][6].

#### 3.2. Innovation in services from the technological approach

Technology does play a role in services [7]. Many prior studies argue that the utilization of advanced technologies, notably ICT, has enabled innovation in services [8][9].

This paper defines innovation as ‘new’ or substantially ‘improved’ services that are new to the market. Those two distinctive service characteristics are identified by the criterion of whether they appeared before or after the paradigm shift of 2009-2010 [10]. Among the two, ‘new’ service characteristics (i.e. that didn’t exist before the paradigm shift and newly emerged in the B2B mobile service market) bring radical systemic changes to B2B customers while ‘improved’ service characteristics (i.e. that existed before the paradigm shift) make the quality of those services characteristics become much better in B2B mobile services after the paradigm shift, than in the pre-existing B2C mobile services (see Fig 1). Hence, ‘new’ service characteristics are linked with radical innovation, and ‘improved’ service characteristics are linked with incremental innovation. A combination of ‘improved’ and ‘new’ service characteristics can be linked with semi-radical service innovation.

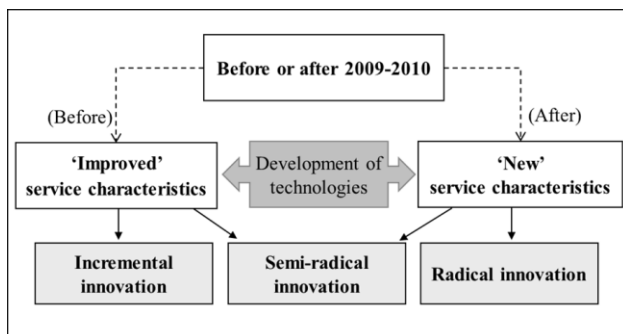


Fig 1. Research framework from the technological perspective

#### 3.3. Innovation in services from the technological approach

Innovation in services can be obtained without directly mobilizing technological characteristics. This study assumes that mobile carriers and B2B service users, as service providers and users, play a dynamic role in achieving innovation by combining or splitting the existing components in service design or by delivering customized services for specific customers at the user/provider interface.

Such competences of mobile carriers and institutional users lead to recombinative and customized innovations, showing two mechanisms. For the first mechanism, mobile carriers develop bundled service brands by combining the characteristics of two or more existing service products. The other mechanism is to provide the customized service characteristics for particular institutional users. These types of innovation may not be achieved through long-term technological advancement, but can be drawn from existing resources by utilizing them creatively in modification or combination with new ones to develop a uniquely different service product. In addition, the institutional users not only deliver their specific needs to mobile carriers, but also participate in the development of mobile solutions as co-producer of service innovation. Such participation brings co-produced innovation.

Fig 2 shows three types of service-oriented innovation in service.

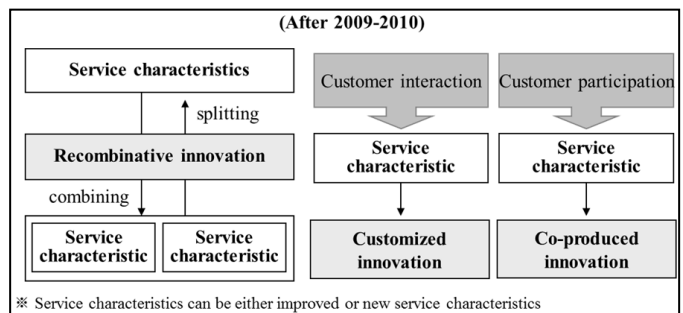


Fig 2. Research framework from the service-oriented perspective

### 4. DATA COLLECTION AND METHODOLOGY

#### 4.1. Data collection

By using data on the market introduction of new services as a service innovation indicator, we examined 242 B2B mobile service products of three major Korean mobile operators. The data of B2B mobile services was collected from the web pages of SK Telecom (<http://www.bizworld.co.kr/>), KT (<http://biz.olleh.com/>) and LG U+ (<http://biz.uplus.co.kr/>). These websites are particularly designed for B2B mobile service business.

## 4.2. Statistical data analysis

### (a) Factor analysis

The service characteristics of B2B mobile services were identified as the first phase of the data analyses. We scrutinized 242 B2B mobile service products of the three Korean mobile carriers. Then, we extracted all service characteristic categories from those service products and divided them into sub-categories as detailed as possible. The characteristics of each service product were converted into a set of 18 dummy variables (1=having a given characteristic, 0=not having it). As a result, a 242X18 matrix of dummy variables was constructed.

Factor analysis was then conducted using principal component analysis with varimax rotation. It reduces a large number of observed variables into a smaller number of factors.

### (b) Cluster analysis

From factor analysis, factor scores were calculated. In the next step, a hierarchical cluster analysis was performed on the factor scores derived from sub-characteristics to classify 242 service products into proper categories. The results were further analyzed with a one-way ANOVA (Analysis Of Variance) as post-hoc test to determine the statistic differences between each group.

## 5. RESULTS: INNOVATION IN B2B MOBILE SERVICES

### 5.1. Classification of B2B mobile services according to service characteristics

After conducting factor analysis, 7 characteristics variables whose eigenvalues were greater than 1 were extracted. In this way, factors can be found to represent variables with similar aspects. For instance,

For instance, ‘general office work supportive’ supports daily business tasks by collecting and analyzing business information or by dealing with a large volume of data. It also includes converting paper-based tasks to internet-based. ‘Facility management’ is the remote control or the automatic monitoring of IT facilities. ‘Location-based security/safety’ means security for equipment or safety of human beings. It often benefits from location-based information. ‘IT Infra management’

builds and manages IT infrastructure in a company, and maintains the adequate level of data security. ‘Seamless working condition’ makes a suitable environment to conduct mobile business by converting paper-based or internet-based tasks to the mobile-based system so that workers can do ordinary tasks without the restriction of time and location. ‘Real-time broadcasting’ provides broadcasting services on real-time basis. ‘Transaction information delivery’ transmits the information on payment or transactions via fixed-mobile network.

B2B mobile service products were classified into seven groups that have different service characteristics through cluster analysis in Table 1.

After investigating which service characteristics are strong in each group, the service groups were characterized as seven service groups having different characteristics: (1) Mobile office/education solutions, (2) Network solutions, (3) Multimedia broadcast solutions, (4) Business analytical solutions, (5) Security and safety solutions, (6) Payment processing solutions and (7) M2M solutions for facility management.

Mobile office/educations enable B2B mobile service users to seamlessly operate an institutional system at any time and in any place. Network solutions ensure fast and stable voice and data transmission. Multimedia broadcast solutions simultaneously transmit broadcast contents. Business analytical solutions provide database-based analytical services to manage a large volume of data. By using location-based information, security and safety solutions protect an institutional user’s equipment in case of theft or loss. Payment processing solutions deliver transaction information and help B2B customer’s operations to be efficient by making payment on the move or on delivery. M2M solutions for facility management secure a building’s entrance or large facilities.

### 5.2. Types of innovation in B2B mobile services from the technological perspective

As we mentioned earlier in Section 3.4, we compared the changes of the seven service characteristics before and after the paradigm shift of 2009-2010, and distinguished between (i) ‘improved’ service characteristics and (ii) ‘new’ service characteristics.

TABLE 1

Service characteristics	Service classification							One-way ANOVA	
	1(n= 19)	2(n=151)	3(n=11)	4(n=31)	5(n=9)	6(n=11)	7(n=10)	F value	Sig.
General office work supportive	-0.097	-0.244	-1.166	<b>1.902</b>	-0.430	-0.374	0.055	53.858	.000*
Facility management	-0.271	-0.052	-0.815	-0.508	0.649	-0.438	<b>3.665</b>	73.682	.000*
Location-based / equipment security /safety	0.010	-0.216	0.088	0.121	<b>4.237</b>	-0.291	-0.718	104.483	.000*
IT Infra management	0.052	<b>0.241</b>	-1.065	-0.210	0.193	-0.523	-1.517	10.009	.000*
Seamless working condition	<b>2.878</b>	-0.332	-0.453	-0.090	-0.298	0.459	0.086	114.792	.000*
Real-time broadcasting	0.006	-0.226	<b>3.601</b>	0.209	-0.314	-0.770	-0.077	76.139	.000*
Transaction information delivery	-0.512	-0.230	0.372	0.033	-0.096	<b>3.700</b>	-0.053	85.442	.000*
Name of service groups	<b>Mobile office /education solutions</b>	<b>Network solutions</b>	<b>Multimedia broadcast solutions</b>	<b>Business analytical solutions</b>	<b>Security and safety solutions</b>	<b>Payment processing solutions</b>	<b>M2M solutions for facility management</b>		

\* P<0.001

As the next step, we matched those improved and new service characteristics with service groups. The new service characteristics led to radical innovation, and the improved service characteristics led to incremental innovation. In this procedure, we finally determined which service groups belong to incremental, radical or semi-radical innovations.

For examples, network solution is a clear example of incremental innovation being created. Compared to network access services for individuals, those for enterprises became highly enhanced in terms of data security and infrastructure management. The B2B mobile network solution not only offers wired and wireless networks but also protects the firm's data, application and network and maintains the security level of IDC (Internet Data Center) through data backup, document conversion server, SSL (Secure Sockets Layer), MDM (Mobile Device Management) system. Hence, the improved service characteristics (e.g. IT Infra management) bring incremental innovation to B2B mobile services.

The M2M solutions for facility management whose characteristic has strong 'facility management' can be referred to as 'radical innovation'. 'Facility management' is a radically new service characteristic that was not necessarily provided to individual users before 2009-2010. But now this characteristic becomes critical, particularly in leveraging the security level of enterprises by combining RFID technology with a CCTV camera. In addition, M2M technology makes it possible to automatically monitor every aspect of a firm's IT resources, from the condition of hardware, software and middleware to their performance on networks.

The service group of 'mobile office/education solutions' belongs to semi-radical innovation because it enhanced the existing service function but also has radically new characteristics to some extent. 'Seamless working condition' characteristic of mobile office/education solution is made up of a mixture of new and improved sub-characteristics. The service platform which is called 'mobile office pack' is an integrated solution that covers groupware and project management functions. This mobilized system radically changes the traditional work style performed during the regular working hours.

### *5.3. Innovation in B2B mobile services from the service-oriented perspective*

The mobile carriers recombine the characteristics of the existing services or develop specific mobile solutions for a particular B2B customer. The new services are made at the interface between the mobile carriers and B2B mobile service users. B2B mobile service users not only deliver their specific needs to mobile carriers, but also participate in the development of mobile solutions as co-producer of service innovation. Hence, the mobile carriers and institutional users can interact with each

other in many cases.

From the service-oriented perspective, such competences of mobile carriers and B2B mobile service users lead to 'recombinative innovation', 'customized innovation' and 'co-produced innovation'. These service innovations highlight the role of mobile carriers and the importance of interaction with B2B mobile service users.

Firstly, mobile carriers create recombinative innovation by mobilizing the characteristics of the existing service products. They produce new service products by bundling 'network solutions' with many solutions such as 'mobile office', 'multimedia broadcast', 'payment processing' and 'M2M solutions for facility management'. 'Payment processing' solutions are often combined with 'mobile office solutions', and thus B2B mobile service users can benefit from multiple service functions.

Secondly, customized innovation is produced at the user/producer interface. Mobile carriers develop customized service offerings to meet particular customer's demands with respect to B2B customer's characteristics (e.g. institution's size and industry). Such innovation plays an important role in enriching the idea of creating diverse service products and attracting many profitable potential B2B customers. Customized innovation allows B2B mobile service users to choose the optimal solution among the pre-defined packages made by mobile carriers. It also emphasizes the role of mobile carrier's direct competence as a private IT consultant for institutional or business users.

Thirdly, in the case of co-produced innovation, mobile carriers design a customized service for a specific B2B mobile service user. B2B mobile service users play an important role as active innovators not only by delivering their needs and preferences to mobile carriers but also by participating in service design and implementation. Such participation brings co-produced innovation. Thus, co-produced innovations make a particular service characteristic beneficial for a specific B2B mobile service user.

These types of innovation may not be achieved through long-term R&D or technological advancement. However, service-oriented innovation can be drawn from existing resources by utilizing them creatively in modification or combination with new ones and by providing a customized service product to particular customers.

## **6. EMPIRICAL CASE STUDY: INNOVATION IN MOBILE CAMPUS**

Based on the findings on Section 5, this paper presents a discussion regarding the dynamic aspects of innovation in Mobile Campus. The results of this section will enhance the characteristics-based innovation models of this paper.

### 6.1. Case selection

We employed a qualitative research design based on field interviews of relevant cases. The interviews were conducted during spring 2011. For the case study, ‘Mobile Campus’ were chosen. Mobile campus is a mobile chip-based campus service that enables to access to campus information via a smartphone and to use various services such as mobile education, e-library, mobile student identification, and micro-payment. We interviewed Information Service Team Managers and vice president of two selected university (UNIST and POSTECH) who are in charge of designing the big structure of mobile campus. Those two universities first started implementing Mobile Campus in Korea (in April and September 2010, respectively) and both are showing good and satisfied results. Mobile campus of those universities is spreading at very fast rate even though it lies in the early phase.

### 6.2. Service features of Mobile Campus at the two university

UNIST signed a memorandum of understanding (MOU) with KT to build the first Mobile Campus in Korea in February 2010, and the service was launched in April 2010. UNIST distributed iPhone 3GS and iPhone 4 to all members on campus including students, professors, and campus staffs. As of March 2011, iPhone was distributed to 2,000 students and 300 faculty and staff members, representing a distribution rate of 80-90%. Mobile Campus at UNIST was especially designed for education, with the purpose of being a “paperless campus”. It pursues a face-to-face, discussion-oriented education. For example, students are requested to watch auditing lectures of well-known overseas professors through video clips on the smartphone ahead of class, and then professors at UNIST only provide students with supplemental lecture that those video clips do not cover. This type of educating allows for students to spend more time discussing in class, instead of wasting their time taking notes.

POSTECH signed an MOU with SK Telecom to establish Mobile Campus in September 2010. It consisted of building a Wi-Fi zone throughout the campus, distribution of free smart phones to campus members, and developing groupware to promote learning without time and location constraints. POSTECH distributed approximately 5,000 units of Galaxy S to all students and faculty members, and most campus members have now received smartphones with a distribution rate of 90%. Mobile Campus has enabled mobility for campus education, administration, and campus welfare at POSTECH. It enables POSTECH students, faculty and staff members to easily stay informed and communicate with others via smartphone at any time and in any place on the campus. The service covers a broad range of categories including education, academic affairs, communication and information

sharing, and campus life support.

### 6.3. Innovation in Mobile Campus

#### (a) Technology-based service innovation in Mobile Campus

From the university’s point of view, smartphone was used as an effective communication channel to access information. Both UNIST and POSTECH took full advantage of the inherent ‘mobility’ of the smartphone. The universities could advance their education systems by adopting the smartphone-based learning solution. For example, students of UNIST were able to watch video lectures freely via smartphone on campus, and were taught only the supplemental part during class that the video lectures did not cover. This way of learning combines both mobile learning and in-person education, and expands educational opportunities for students, and frees them to spend more time enjoying interactive discussions and debates in class.

Smartphone enhances the value of the pre-existing service for individual service users such as mobile payment and network solutions (i.e. transaction information delivery). When these solutions are provided to universities, the service value is enhanced. For example, Mobile Campus of UNIST provides micro payment solution to the university. It is a mobile transaction that can be used for digital purchase on campus such as books at a campus bookstore and meal at a student cafeteria. For this solution, Near Field Communication (NFC) is used as a key technical tool for over-the-air financial transactions. NFC provides UNIST with a quick and easy way to use micro payment service.

On the other hand, ‘security’ solution of campus facilities is a new service to the universities that secures the university’s resources in innovative ways. For example, Mobile Campus enables universities to build a security management system. When campus members enter a library or important facilities, they can simply use their smartphone as an ID authorization tool. In this case, smartphone plays the role of mobile student ID card. Particularly, the security function can make the camera function on the phone not work in some areas where taking a photo is not permitted by recognizing phone number of those who enter the secured area and stopping the camera function of them.

Thus, a new service characteristic, ‘security’, appeared in Mobile Campus with support of various technologies. Such ICT-led service innovation in Mobile Campus provides the two universities with a suitable solution and creates a new service feature of campus facility security.

#### (b) Mobile carrier-driven service innovation in Mobile Campus

Network build-up of mobile carriers shows the recombinative mode of service offerings. The existing technical resources were reallocated by the mobile carriers to build up the network infrastructure for Mobile

Campus. New wireless Access Points (APs) were installed in places where people frequently move from one zone to another, for instance near the entrance of a building or outdoors on campus. In contrast, the old APs existing on campus were insufficient to support simultaneous voice over Wi-Fi. Thus, they were reallocated in confined spaces above the third floor of a building such as classrooms, laboratories and office rooms, where people do not frequently move and remain stationary.

In addition, Mobile Campus itself is designed as a recombinative service by integrating various service functions such as education, student's campus life support and campus administration. Thus, these service offerings are based on a combination of various mobile applications that have been provided separately to individual customers. Such campus-wide services are combined to implement the full service feature of Mobile Campus for a university.

*(c) University-driven service innovation of Mobile Campus*

In the case of Mobile Campus, it is at the user-provider interface that innovation occurred. As institutional customers, UNIST and POSTECH were actively involved in the service development process of Mobile Campus, for instance in developing and implementing Mobile Campus. As a service user, UNIST clearly delivered its feedback and suggestion to the mobile carrier, and POSTECH designed its own specialized contents.

## 7. CONCLUSIONS AND IMPLICATIONS

This paper identified the service innovations in B2B mobile services through statistical techniques and in-depth examination in Mobile Campus. We developed a comprehensive approach to analyze the factors affecting innovations in B2B mobile services. The service innovations were discussed from the two different perspectives. From the characteristics-based approach, a scheme for distinguishing new and improved service characteristics was devised by applying the concept of the paradigm shift to the framework. It enabled us to define incremental, radical and semi-radical innovations from the technological perspective. The competences of mobile carriers and the increasing role of institutional users were clarified in mobile service innovation from the service-oriented perspective: recombinative, customized and co-produced innovations.

This paper has some theoretical and empirical implications.

Firstly, this paper suggests that service innovation can be studied from technological and non-technological perspectives through various research methods such as statistical analysis and examination of the innovation indicator in the product level. However service

innovation study is still able to account for a much broader range of possible sources of innovation. The research method in this paper could be applied to other industries and other businesses whose products are standardized and clearly detected. Although this paper relied on web-based data collection and desk research, future case studies can have more practical implications by conducting field interviews.

Secondly, this paper has several implications for the mobile carriers in any country such as Korea or Japan, whose market is mature and faces problems of mobile subscriber saturation and fierce competition. Under these circumstances, innovation in B2B mobile services can show the increasing potential of mobile business opportunities in B2B areas. Such B2B mobile service is growing fast and its transaction volume is large. This suggests that a mobile carrier can produce further revenue and find a new business opportunity in various industries such as education, healthcare, manufacturing, construction, and public services. Therefore, future research should include findings on a case study of Japan to make the empirical results in this paper more fruitful.

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