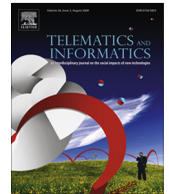




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Dynamic change of manufacturing and service industries network in mobile ecosystems: The case of Korea

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ABSTRACT

As the importance of symbiosis and cooperation in mobile manufacturing and service industries is increasing, the concept of mobile ecosystems has been especially highlighted. The mobile manufacturing and service industries interact with each other to produce value-added and synergy effect, constructing ecosystems. In this respect, the structure of mobile ecosystems becomes quite complex and the identification of ecological roles need to understand ecosystem relationships among mobile industries. Thus, this study aims to explore the dynamic change of the mobile ecosystems for identifying the trends of mobile industries in the case of Korea. First, a change in the structure of mobile ecosystems is visualized in terms of network topology. Second, the impact and ecological roles of manufacturing and service industries are identified using the centrality analysis and brokerage analysis. From these results, the dynamic change map is constructed for identifying the history of Korea's mobile ecosystems as well. As a result, this dynamic analysis of mobile ecosystems is expected to help policymakers monitor the change in impact and network position of mobile manufacturing and service industries.

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1. Introduction

The mobile communications industries have been mostly controlled and managed by both manufacturing and service industries. Traditionally, phone device manufacturers and mobile network operators (MNO) played a dominant role in the manufacturing and service industry of the mobile industry, respectively (Holzer and Ondrus, 2011). Recently, the power of mobile devices is rapidly enhanced and the speed of mobile data network highly increases through ICT technology and mobile broadband network (Bohlin, 2007). In response, the value network of manufacturing and service industries has changed by the arrival of new mobile smartphones, such as the iPhone and Galaxy series, and mobile application platforms, such as iOS and Android (Suh et al., 2012). Also, many contents and media services such as game, movie and music have been delivered exponentially. Thus, mobile manufacturing and service industries have become complex and moreover and its structure and value chain are evolving with the emerging mobile industries (de Reuver and Haaker, 2009).

Focusing on the evolution of ICT and mobile industries, some of the socio-technical studies have proposed the transition stage or process of industrial evolution as well (Shin et al., 2011; Phaal et al., 2011). During the evolution process, some actors have lost their own dominant positions in the value network, whereas some play a critical role in interacting with

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other actors. In this situation, the concept of mobile ecosystems emerges to reflect changing relationships of major actors and their dynamic structure.

The mobile ecosystem is particularly appropriate for taking the recent change of relationships between mobile manufacturing and service industries into account. In the ecosystem perspective, it is important that the change of complex interaction in a system can be explained with the resource flows by defining the familiar ecological terms. In previous study, the key characteristics of their interaction are suggested, such as symbiosis, platform hub and co-evolution (Rothschild, 1990; Li, 2009). Three ecological roles are usually suggested as well, such as keystone, niche and dominator (Iansiti and Levien, 2004; Peltoniemi, 2006). These roles are capable of identifying the complex relationships and making it easy to understand the overall system. Using these roles, the structure and value chain of the mobile ecosystem can be more clearly explored.

However, previous studies on mobile ecosystem, as noted above, still remain as the conceptual framework and qualitative research. This limitation is threefold. First, the structure of mobile ecosystems is less analyzed in terms of resource flows between industries. Some of the studies present the mobile ecosystems using firms' M&A or collaboration data (Iansiti and Levien, 2004; Basole, 2009), but the ecosystems needs to be considered as macro view because the ecosystem phenomenon influences on the industry or nation economy. Second, ecological roles have not been defined through quantitative measures. Through inflows and outflows of resources, the mobile ecosystem can be organized and constructed. Finally, although many studies indicate that mobile ecosystems have been changed thus far, the quantitative dynamic change is relatively less analyzed and reported.

Thus, this study aims to quantitatively explore the change of relational structure and ecological roles in the ecosystem. The research purpose focuses on visualization, ecological roles and dynamic change. First, for the mobile ecosystem, the manufacturing and service industries network is constructed and visualized. For analyzing the mobile ecosystem, we use the inter-industry resource flow contained in the input–output table. The network visualization is indicative of monitoring the mobile ecosystem structure and exploring the relationships between manufacturing and service industries. Also, the characteristics of manufacturing and service industries are described in terms of topology types of network.

Second, through the impact and relationships of mobile industries, the ecological roles are defined in the ecosystem perspective. In order to evaluate the industries' symbiotic impact, two roles of "donor" and "absorber" are defined for identifying the direction and amount of the resource flows in the ecosystems. The *donor* is an actor who provides more outputs than inputs to others, while the *absorber* is an actor who receives more inputs than outputs from others. For healthier ecosystems, donors are more included than absorbers. As a heavy absorber may destroy the entire ecosystem, this actor is mainly managed to provide more outputs to others. To identify both roles for the symbiotic impact, we use the centrality analysis of network. However, using only the impact, it is difficult to explain the industries' network in mobile ecosystems. Thus, we need to monitor the hub network relationships of industries in mobile ecosystems. Hence, five types of hub roles, including *coordinator*, *gatekeeper*, *representative*, *consultant* and *liaison* are identified using the brokerage analysis. The brokerage analysis is informative for deriving the platform hub in network relationships of industries, consisting of mobile ecosystems. Through the analysis of both impact and interaction, the mobile ecosystems are represented with mobile industries.

Finally, through a dynamic analysis, we identify the change of manufacturing and service industries based on the ecological roles. As a result, the four patterns of dynamic changes are revealed: adaptation, dominator, migratory, and settler. These patterns are expected to help policymakers to understand the dynamic change of mobile ecosystems and to maintain balance among resource flows of mobile industries economy. Further, the policymakers can consider the technology and market stimuli through the change of dynamic patterns.

To be specific, the case of South Korea (hereafter Korea) is presented. Korea's mobile ecosystem has been rapidly developed with the increasing number of companies in mobile industries. Korea is widely accepted as a strong Internet nation with high capacity infrastructure such as wire and wireless communications (Lee et al., 2009a,b). The capacity of mobile traffic has been then expanded to the mobile broadband infrastructure such as CDMA and IMT-2000 as well. The ICT policies of Korea have led to success of the large firms for mobile devices and broadband services, such as *Samsung* and *Korea Telecom (KT)* in the Korean and global markets. Further, based on combination between the recent advanced smartphones and 4G communication technologies, the manufacturing and service industries more interact to create new ICT platforms. For example, new media and contents services are provided using various mobile devices in Korea (Kim, 2011). Thus, it is particularly true that the Korean mobile industry has transformed to *mobile ecosystems*. As the ICT policy is recently formulated under the hegemony of "*Creative Economy*" of the Korean government, the management of mobile ecosystems is especially interesting in academia and practice. Through the analysis of ecosystem dynamism, it is helpful for policymakers to analyze how to change structure of mobile industries and to find which industries are supported for balance of mobile ecosystems.

2. Background

2.1. Previous studies on ecosystems

2.1.1. Concept of ecosystems

An ecosystem is an environment in which different species coexist through mutual interaction and the influence of various external forces. Within an ecosystem, one species affects and is affected by other species (Basole, 2009). Similarly, as aforementioned, the ecosystem perspective in the industry and business has begun to suggest a biological ecosystem, which

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