

THE LOCAL INNOVATION PERSPECTIVE: DEVELOPMENT OF MOBILE-HERBAL SERVICE FOR INDONESIA'S MOBILE CELLULAR MARKET

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ABSTRACT

This paper reports on local innovation in the Indonesian mobile cellular market. From the local perspective, innovation opportunity appears when it suits characteristics of the country and behaviors of its people. The realization of such an opportunity has been enabled by development of a mobile-herbal (*m-herbal*) service application. The service has been designed according to the following framework: *scanning the market demand, defining specific applications, defining the actors, exploring tacit knowledge of the actors, and developing engineering functions for support of implantation innovation and concurrent innovative development*. We used the results of a previous market survey emphasizing a need for health-related services in the Indonesian market. Herbal remedies were chosen collectively as the focal point of health-related service development since it is well-known that indigenous methods of treatment using Indonesian natural ingredients are employed commonly. The service has been developed to run on an Android-based smartphone, which connects to the database called Indonesian HerbalDB. It consists of two main features: queries (searches) regarding herbal remedies and a self-evaluation. Users of the service may search the names of traditional Indonesian plants, their local names, and the kinds of diseases that can be treated by using them. Through self-evaluations, users are encouraged to describe their personal perceptions of certain herbal remedies and recommend them to other users. Finally, our proposed framework signifies the importance of communications channels among actors in the mobile cellular network and the necessity of facilitating mutual interaction between multiple actors involved in the development of *m-herbal* services.

Keywords: Android; Herbal; Indonesia; Innovation; Mobile technology; 4G

1. INTRODUCTION

A series of technological advances in the mobile cellular industry (e.g., from 1G to 4G) has indicated an increased performance of data communications services. Progress has also been facilitated by the rapid diffusion of smartphones over the global market. Consequently, various mobile service applications are appearing, and they can be easily obtained through the Internet platform. Our previous works argued that such phenomena lead to innovation opportunities for developing countries as well as industrial actors (Suryanegara & Miyazaki, 2012). For identifying such opportunities, each country should be able to focus on a specific area for use via mobile technology (Felita & Suryanegara, 2013).

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Regarding the National Innovation System, the focus is fostering science and technology activities in several emerging research areas (Suryanegara & Miyazaki, 2012). Meanwhile, for industrial ecosystems, opportunities stem from utilization of mobile service applications. A consequent question explores the kind of service that should be developed for the corresponding market. The answer can be formulated by identifying windows of opportunity through a market survey. In Indonesia, a recent work has reported the results of a survey about applications that are needed for the Indonesian market (Suryanegara & Asvial, 2013); accordingly, health-related services are among the most anticipated applications. Under the local innovation perspective, it is argued that the service application should match the global trend as well as the target market characteristic. Therefore, this work aimed to develop an application that engaged the local innovation perspective of the Indonesian market—hence, *m-herbal*. Herbal remedies have been identified for engineering development, as Indonesian natural ingredients are used popularly as traditional methods of treatment.

2. UNDERLYING THEORIES

2.1. Innovation Studies on Mobile Technology

Recognizing the importance of creativity, entrepreneurs, and capitalism, Schumpeter (1928) introduced the concept of innovation as part of an effort to stimulate a country's economic growth. Referring to Malerba (2004), it also can be said that innovation is the exchange and generation of knowledge involving various actors, which leads to the introduction of products and services and their market commercialization. By linking the terms “innovation” and “mobile technologies,” it is noted that innovation has always been a driving force for creating products and service applications in the mobile technological sector. The implementation of cellular networks resulted from technological innovations that produced handsets, base stations, network switching systems, mobile switches, and other relevant hardware. Meanwhile, Internet-based applications such as Google Maps and YouTube are product examples of innovations in services.

In the case of mobile technology, service innovation has taken on a significant role, especially since the advent of 3G technology and the subsequent creation of multi-service platforms. The strategic perspective of service operators has been affected, and innovation in service is becoming more crucial for success (Suryanegara & Miyazaki, 2010). Along that same vein, Suryanegara (2012) proposed an evolution model for *quality of service* over the series of mobile technological developments (1G to 4G). The model clarified that service operators should continuously learn and adapt to the market, thereby facilitating knowledge creation and development of various kinds of applications. A contradictory argument explains that service innovations operate effectively on the basis of coupling mechanisms with other supporting technologies in a mobile ecosystem framework. Competitiveness is based on how service operators can make use of technological advancements in the hardware and connect them with service innovations.

New services will not always be automatically accepted by the competitive market. They require value propositions that should be defined by considering the prospective market. For example, national telecom players should have opportunities to develop service applications that suit the characteristics of their respective countries. However, because of data services, the mobile technology market no longer relies on national operators or local providers because new applications are provided and managed within the global Cloud (i.e., utilization of hardware and software resources elsewhere in the Internet). The virtual borderlessness of data communications has enabled the national market to utilize applications developed outside a country; consequently, national operators have begun shifting their functionality from network and service providers to network providers (Suryanegara & Asvial, 2013).

2.2. The Indonesian Mobile Market

Indonesia is the largest island country in the world based on population and the fourth largest market in the world with approximately 240 million people. At present, Indonesian operators are ready to implement 4G technology. However, they face a dilemma in anticipating such technology. Most applications have been designed so that anyone can join the industrial ecosystem and benefit from the market. Operators will generate revenue only by selling the network, but they still must spend money on building the physical infrastructure. The role of the market is strengthening, prompting specific features in 4G applications. Therefore, operators must develop an appropriate service application strategy to match the specific demands and behaviors of the Indonesian market.

The study by Suryanegara and Asvial (2013) formulated the characteristics of upcoming 4G mobile service applications that could be diffused in the Indonesian market. An analysis was conducted to identify a pattern in market responses to various kinds of upcoming mobile service applications. A survey was administered to a sample of prospective Indonesian users in May 2013. The questionnaire listed several 4G services, of which some are anticipated for the near future. In fact, some are already emerging. Respondents were requested to choose one of four options (*very eager*, *eager*, *still doubtful*, *reject*). The map of responses is shown in Figure 1.

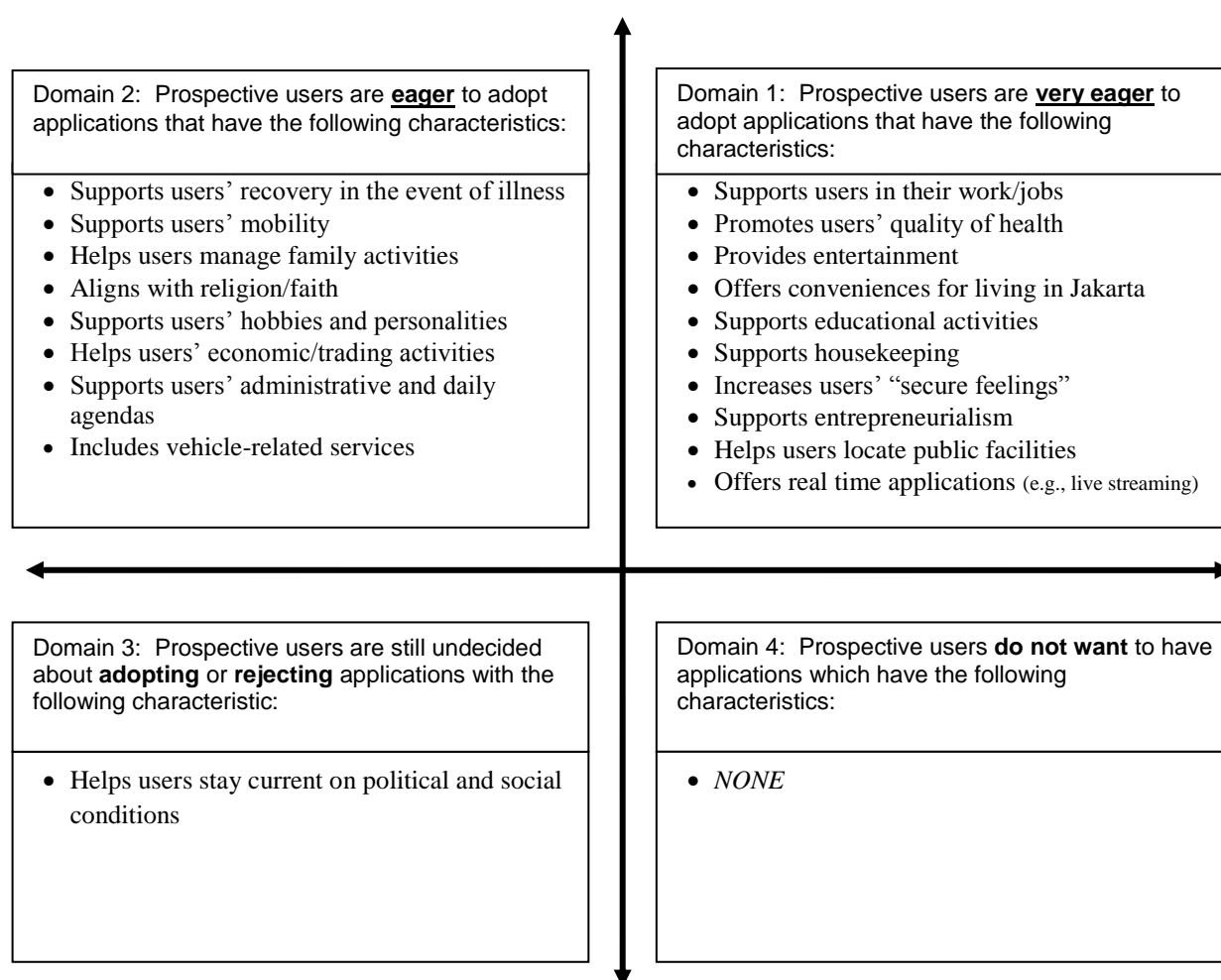


Figure 1 Map of response trends regarding upcoming service applications (Suryanegara & Asvial, 2013)

Referring to Domain 1 in Figure 1, the findings have shown that a health-related service is a highly anticipated application. A majority of prospective users have also indicated an eagerness

to adopt applications supporting a subscriber’s work-related responsibilities. Figure 1 also reflects the message that the Indonesian market would be very eager to adopt applications related to the country’s conditions. As Jakarta is one of the busiest and largest cities in Asia, applications specifically designed to make living in Jakarta easier would be adopted swiftly. Another special characteristic is to increase “a feeling of being secure,” which can be associated with the city’s crime statistics (Suryanegara & Asvial, 2013).

3. THE LOCAL INNOVATION MODEL

We have argued that the design of mobile services for implementation in the 4G era should reflect a balance between global trends and a target country’s specific characteristics. In principle, this concept combines global and local paradigms; thus, it is called the *local innovation perspective*. How do we incorporate this perspective into a specific mobile technological service? Taken from our previous work, Figure 2 shows a proposed model for incorporating the local innovation perspective into the design of service applications for the advancing Indonesian market (Suryanegara & Asvial, 2013).

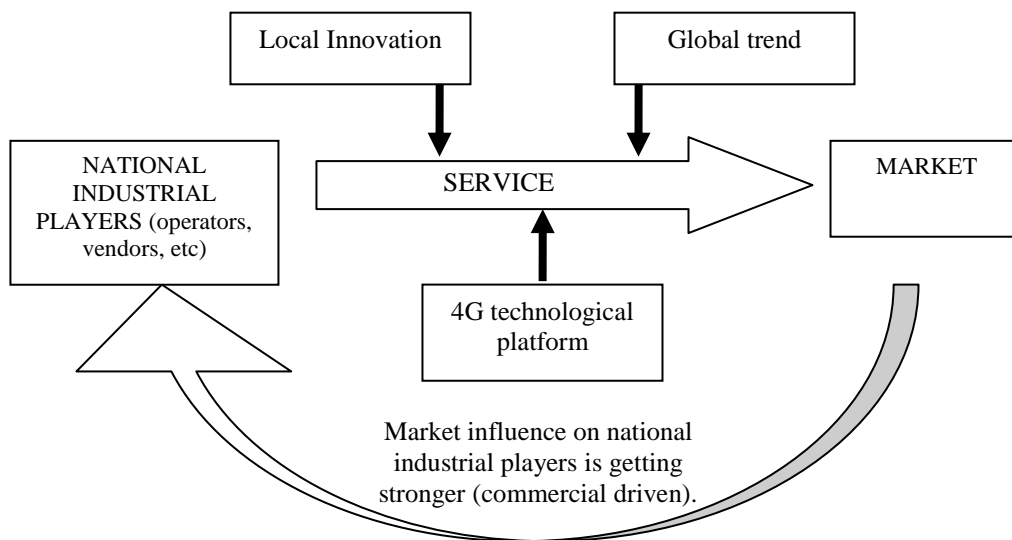


Figure 2 Innovation perspective regarding the future Indonesian market (Suryanegara & Asvial, 2013)

The map in Figure 1 indicates that the anticipated Indonesian market demand will be relatively similar to the current global trend. The list of prospective applications reflect common services that are already available or in the design phase for the global industry. Under the local innovation perspective, opportunities may appear when they are matched with the Indonesian situation. For example, findings indicate that users are eager to adopt service applications to increase “health quality.” Thus, for adaptation in Indonesia, mobile health applications must be designed to suit the relevant health behaviors of the country (Suryanegara & Asvial, 2013). The combination of global trends and local perspectives can be supported by the advancement of 4G mobile technology, with its higher data rate and greater mobility.

With our model, we also argued that the designed service should have the potency to be supported by relevant innovation actors. In fact, the model is built on the basis of the existing theoretical approach. Rogers (1995) has noted that technological innovation should be communicated over time among the members of a system. Subsequently, it is important to pay attention to the potency of diffusion as well as the actors involved. Bessant and Davies (2007)

defined innovation as “the successful exploitation of new ideas.” Ideally, an innovation performs efficiently in a network system in which components and actors are interconnected and exchange knowledge from creation to commercialization.

4. DEVELOPMENT OF THE MOBILE HERBAL (M-HERBAL) SERVICE APPLICATION

4.1. Scanning the Demand Based on Survey Data

Based on the Indonesian market, we have built the *m-herbal* service application by engaging a technological design that aligns with the local innovation perspective. Such a perspective is developed through a proposed framework, as shown in Figure 3. First, it begins with a question: What kind of application should be developed to meet the local Indonesian demand? An answer can be offered after looking at the results of the market survey described in Section 3. There will not be a single dominating service; a variety of services is anticipated, which means technological opportunity also abounds. From Figure 1, we recognize that prospective users tend to adopt services that support work activities, health, growth, and development of families, education, and business; further, they value entrepreneurialism (Suryanegara & Asvial, 2013).

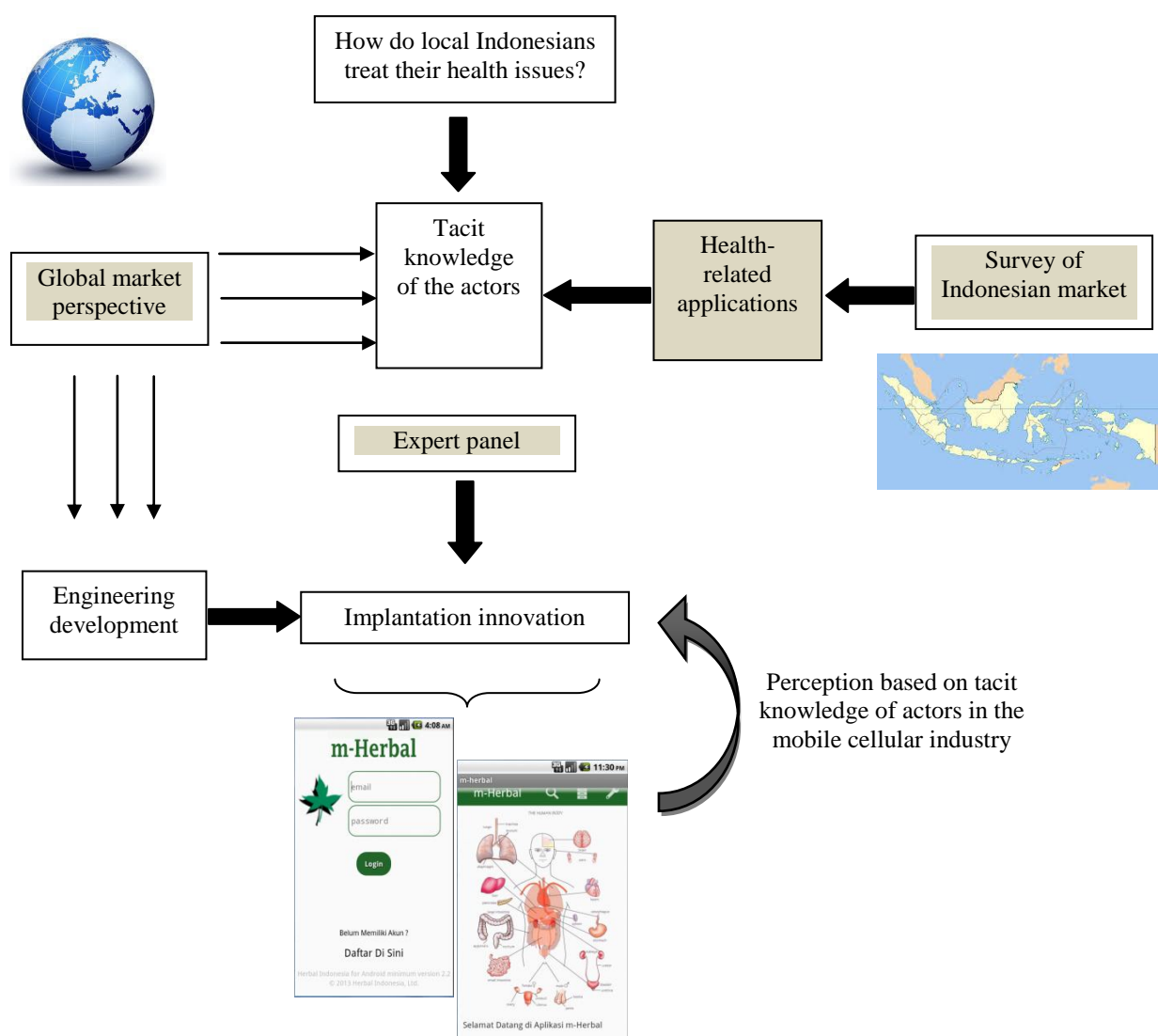


Figure 3 Framework of *m-herbal* development

4.2. Defining the Specific Applications

The next step is to define the specific service applications and relevant actors. A common conception emphasizes two generic characters on which the proposed applications should have a higher probability of market acceptance and support from relevant actors in the innovation sector. A crucial finding is that users are eager to adopt service applications that promote “health quality” (Figure 2). According to the local innovation perspective, the opportunity appears from such a service when it is matched with the Indonesian situation. Therefore, application design suits the characteristics of the country and the nature of its people. On the other hand, since the diffusion of innovation is rated based on the number of people utilizing the services, it is also important to look at health-related behaviors of most Indonesians.

We pointed out the common Indonesian practice of using herbal medicine—a reference point for service innovation development. Herbal remedies are used according to the well-known indigenous method of treatment with natural ingredients—in particular, medicinal plantation. Herbal remedies utilize “all natural” ingredients that contain substances or materials for therapeutic or healing purposes.¹ A treatment employs a concoction of ingredients from herbs and natural elements. A main distinction from modern medicine is that the content of substances of herbal medicine does not only cure people but also increases their endurance significantly. In a developing country, herbal medicines attract most of the population since they provide cheaper solutions to medical problems with components found easily in the environment.

In Indonesia, herbal medicines have been recognized widely over time and passed down through generations according to the prevailing customs in the society. Moreover, before the advent of fabricated chemical medicine, the use of medicinal plantation was the only treatment known to the public. Table 1 provides examples of common herbal medicines that are consumed practically by Indonesians.

Table 1 Examples of herbal medicines consumed practically by Indonesians

Disease/Symptoms	Herbal Medicines (Latin Name)	Local Name
High blood pressure	<i>Celery (Apium Graveolens)</i>	<i>Seledri</i>
Diarrhea	<i>Guava [its leaves]</i>	<i>Daun jambu biji</i>
Cough	<i>Citrus, Ginger</i>	<i>Jeruk nipis, jahe</i>
Gastritis	<i>Aloe vera</i>	<i>Lidah buaya</i>
Hyperlipidemia	<i>Garlic (Allium Sativum)</i>	<i>Bawang putih</i>
Decreased vitality	<i>Panax ginseng</i>	<i>Ginseng</i>
Typhoid fever	<i>Curcuma</i>	<i>Kunyit</i>

¹Medicinal plants have medicinal properties; they can be easily found throughout Indonesia. Indonesian herbal medicine originated thousands of years ago. Typically, in a rural environment, every household has been growing such plants that can be used as herbal medicines, such as *aloe vera*, *turmeric*, and others. Based on the raw materials used for herbal medicine, the plants' components can be classified as follows (Wulandari & Suparni, 2012) :

- The leaves, such as bay leaf, betel leaf, leaf cottonwoods, and others
- The trunk, such as cinnamon, brotowali, pulasari, and others
- The fruit, such as lemon juice, cilantro, star fruit, and others
- The seeds, such as amethyst, areca nut, nutmeg, and others
- The roots, such as papaya, palm, the island of Pandak, and others
- The tubers or rhizomes, (e.g., kencur, ginger, bengle, and others)

After defining the specific applications, we considered the current global trends. Most Internet healthcare applications are references for users. Thereby, mobile users connect to a database that provides solutions and suggestions related to users' health problems. Following this perspective, we designed the *m-herbal* service, which provides consultation functions as medical solution references.

Despite the fact that herbal medicines are associated with traditional lifestyles, herbal medicine in Indonesia has been fabricated and commercialized in the form of modern products (e.g., branded capsules and tonics). Therefore, we can identify the relevant actors engaged in such activities: 1) actors in the stage of knowledge creations, 2) actors in the stage of commercializing herbal products, 3) actors regulating the diffusion of herbal medicines, and 4) actors utilizing herbal products, representing the market/users. Regarding the stage of knowledge creation, the Faculty of Pharmacy, Universitas Indonesia, is actively performing research activities. In the stage of commercializing products, individuals and firms are actively engaged in developing herbal products, and the Ministry of Health regulates the utilization of modern herbal products for safe consumption by humans.

4.3. Exploration of Actors' Tacit Knowledge

The great strength of the innovation systems approach is the focus on the role of non-market institutions and processes in fostering innovation (Metcalf & Ramlogan, 2006). Increases in service complexity and required knowledge have led to innovations that are multifaceted, requiring suitable *communications channels* to share and exchange information and knowledge. Further, knowledge requires a common platform to enable technological innovation construction. By nature, the development of any technology is considered to be a complex phenomenon, involving a multidimensional perspective. Therefore, technology is more valuable when more actors participate in its development. In the ideal condition, the participation of multiple actors is made possible through a communications channel.

Unfortunately, in the case of Indonesia's *m-herbal* development, a suitable communications channel does not exist. Therefore, we attempted to explore tacit knowledge of the actors by conducting in-depth interviews with the aim of replacing a communications channel in the herbal sector with knowledge exchange and mutual interaction between actors for technological development. Actors were requested to explore their views regarding issues associated with the use of herbal medicines in Indonesia. Thus, specific values were associated with unique innovations and distinctive services. Results of interviews with the actors are provided in Table 2.

4.4. Engineering Development

The system architecture for *m-herbal* applications runs through the Android OS handset. There must be a connection with the herbal database through the Internet. Applications only access the URL address that has been initiated via the handset application; users may request that relevant data be stored on the server. The database used is the MySQL platform, which refers to the Indonesian Herbal Database (*HerbalDB*) created by the Faculty of Pharmacy, Universitas Indonesia (Yanuar et al., 2011). The database includes more than 3,000 species of medicinal plantation that represent the main data references for the Indonesian *m-herbal* service application. Subsequently, the server responds to requests and sends data via the Internet directly to the application on a smartphone.

Table 2 Results of in-depth discussions

Actors	Role in the Herbal Sector (Knowledge Accumulation)	Main Conceptions
Knowledge creators	Two academicians working as university researchers in the field of herbal innovation	<ul style="list-style-type: none"> – Herbal medicines are strongly related to user-oriented perceptions. Unlike with modern medicines, the benefits of herbal medicines have not been scientifically or clinically proven. – Perceptions regarding how herbal medicines solve health problems are divided into those of “doctors” and those of “the people.” For example, a cough is basically a symptom of disease, but the general public often perceives it as a disease. Thus, clinically oriented herbal treatments reduce symptoms, but “the people” believe that they actually cure diseases. – In principle, herbal medicine increases immunity by balancing the body’s conditions. Clinically, Western medicine is oriented toward killing the origins of a disease with antibiotics. – A diagnosis in herbal medicine still follows the protocol of Western medicine’s clinical diagnosis.
Knowledge commercialization	Two herbal practitioners experienced in creating herbal medical products	<ul style="list-style-type: none"> – In spite of disease similarities, treatments may vary by region. – There must be an effort to educate people and promote a healthy understanding of medical conditions. For example, the symptoms of diarrhea and dehydration are typically not perceived differently by traditional people, so there must be an educational element to ensure that a distinction can be made between the two diseases.

A use case diagram effectively describes details of user interaction with the server (Figure 4). From mobile handsets, users must log in, then enter the “home” of the *m-herbal* application. From “Home,” the user can query (search) the herbal data, view a forum, and share experiences. In the query process, users are able to run a searching mechanism based on four criteria: the medical plantation species (Latin name), its common name (known by tradition), its alias name, and its clinical benefits (names of diseases it is used to treat). The forum functions as the medium for users to share their experiences with certain diseases, along with their recommendations for suitable herbal medicines. The information is used as reference material for other users who may be experiencing symptoms of the same disease or sickness. Figure 5 provides a snapshot of the application side.

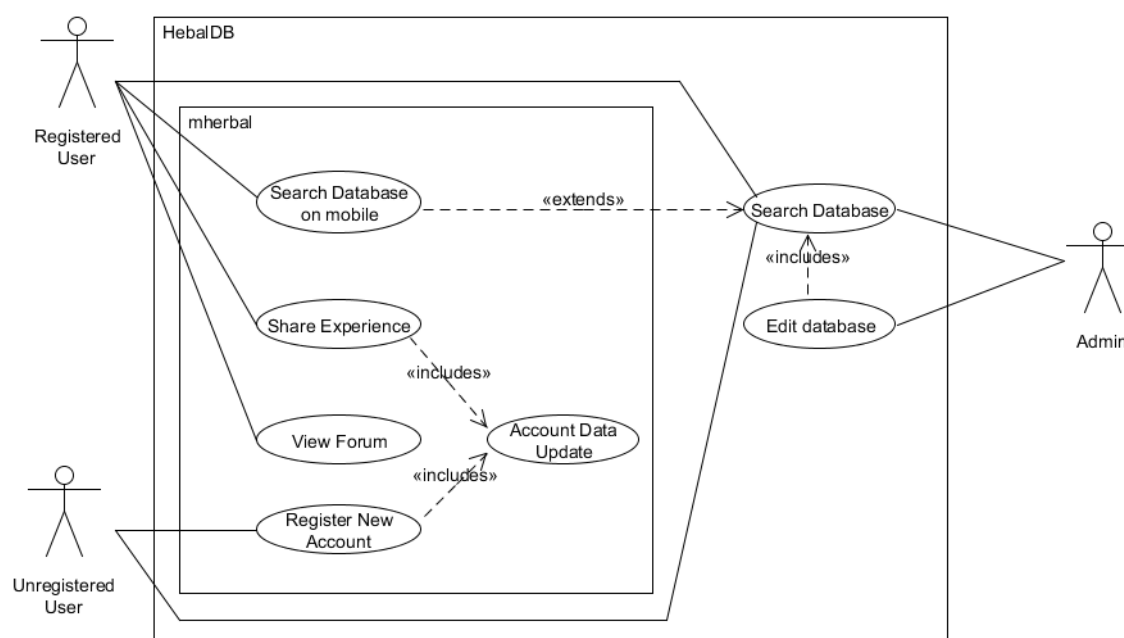


Figure 4 The use case diagram of the *mobile-herbal* service application

4.5. Implantation Innovation

We proposed innovation values in the self-evaluation. This feature was designed specifically in response to the results of interviews. The actors assigned values to the unique characteristics of herbal medicines based on user-oriented perceptions. It is difficult to find evidence-based justification of herbal medicines. Therefore, we are utilizing a concept in which users are requested to conduct self-evaluations of certain herbal medicines. Basically, once users start consuming a certain herbal remedy, they are requested to mark a series of heart symbols representing personal perceptions about their health condition during the consumption period. For example, if a user suffers from diarrhea and begins consuming “the leaves of guava,” he/she will mark two heart symbols (out of five) on the first day, indicating that his/her health condition is relatively weak. On the second day, after consuming the guava leaves, and presumably perceiving an improvement in health, he/she will mark four heart symbols. On the third day, if fully recovered, five symbols would be marked. The progressive increase in symbols will be published for other users by way of the forum feature. Subsequently, the sharing of experiences acts as providing recommendations for “the leaves of guava” as the herbal medicine for other users who suffer from diarrhea (see Figure 5).

4.6. Concurrent Innovations for Implementation in the Mobile Cellular Network

An ideal innovation system performs in a network system in which components and actors are interconnected and involved in the exchange of knowledge from creation to commercialization. For example, operators need to know what kind of service can be implemented and accepted by the market, whereas regulators must establish a set of rules regarding the service. Under this theoretical approach, we showed the designed innovation services to actors of mobile cellular sectors. We captured their responses to questions designed to extract their tacit knowledge of the telecommunications industry. The aim was to obtain perspectives on implantation of the innovation since the *m-herbal* application should, eventually, be applied over multiple mobile cellular networks. We worked with an expert panel involving 13 actors from the industry (i.e., seven from mobile network operators and six from mobile technology vendors). The *m-herbal* services were shown to the panel, and members were requested to give relevant comments.

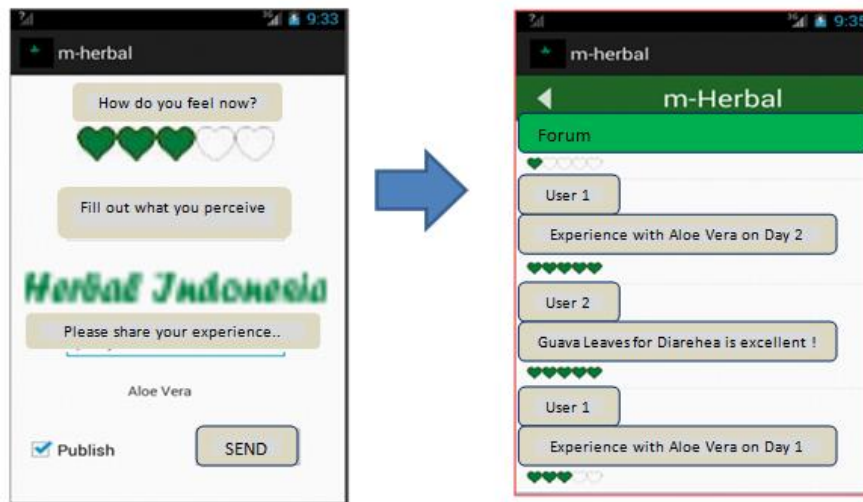


Figure 5 Snapshots of the self-evaluation feature and forum

Table 3 lists comments from the 13 actors, which can be considered for further *m-herbal* service development. The table shows a different perspective between actors who are implementing mobile technology practically and those who are more focused on how innovations can be diffused throughout the market. In the latter case, the application of *m-herbal* was assumed to be a prototype applied readily in the cellular network. Uncertainties about successful applications are decreasing, as the actors did not reject the service. Some factors emerged as technical matters (e.g., related to tariffs and service quality). The intensity of relationships with customers is becoming important, as the issue of “customer care” is a concern among industrial actors. Commercialization of service was identified as another important aspect; it includes an operator’s ability to maintain utilization of *m-herbal* services by the Indonesian market.

5. CONCLUSION

We have discussed the development of *m-herbal* as a local innovation in Indonesia. The application was developed using a model of the anticipated Indonesian market. This model can be used to determine health applications that are relevant to Indonesian market behavior. We chose herbal medicine as the focus of the application. An activity diagram and use case diagram were used to describe the design of the application. As stated previously, the application consists of two main features—queries regarding herbal remedies and a self-evaluation by which users are encouraged to give their personal perceptions of various remedies as recommendations to other users. Finally, our proposed framework signifies the importance of communication channels among actors in the mobile cellular network to facilitate mutual interaction between the multiple actors involved in *m-herbal* development. We obtained the actors’ tacit knowledge from the perspectives of knowledge creators and mobile cellular ecosystem actors.

Table 3 Comments by actors in the mobile cellular ecosystem

Actors	Role in the Herbal Sector (Knowledge Accumulation)	Main Comments
Actors who implement knowledge in the mobile cellular ecosystem industry	Seven actors working as Indonesian mobile network operators	<p><i>Comments related to evaluations of current application:</i></p> <ul style="list-style-type: none"> • <i>M-herbal</i> needs to perform diagnoses, not only provide disease information. • The database should be well-structured and more complete. • <i>M-herbal</i> should be more user-friendly and complete with figures. • The login access needs to be integrated with popular social media. <p><i>Comments related to service implementation:</i></p> <ul style="list-style-type: none"> • The service should be managed as a customer relationship. • The service should be integrated with a single billing account. • The tariff should be competitive. • An easy payment system is a must, and the service should utilize mobile money. • The service should be able to perform an early network detection problem • Having good quality and coverage is important. • Customer care is a must. • For promotion, consider free services (as well as fewer advertisements).
	Six actors working as mobile technology vendors (including foreign suppliers)	<p><i>Comments related to evaluation of current application:</i></p> <ul style="list-style-type: none"> • <i>M-herbal</i> needs personalization. • <i>M-herbal</i> should be able to track health history records. • <i>M-herbal</i> should explain how to make herbal medicine from leaves/s. • <i>M-herbal</i> needs to motivate people to live healthy. • <i>M-herbal</i> needs to provide faster response <p><i>Comments related to service implementation:</i></p> <ul style="list-style-type: none"> • The tariff should be competitive. • Service should be easily accessed. • QoS should be good. • <i>M-herbal</i> should have an attractive design and layout. • Good network quality is a must. • Users should be able to easily check billing and pay the bill. • <i>M-herbal</i> should provide good and continuous updates.

6. ACKNOWLEDGEMENTS

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