In searching for 4G mobile service applications
The case of the Indonesian market

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The role of the mobile telecommunications market is getting stronger, prompting a demand for new features from 4G applications. By focusing on the case of the Indonesian market, this paper analyses the characteristics of the upcoming 4G mobile service applications which might be popular in such a developing country. To construct the analysis, we conducted a survey over a sample of people representative of the likely market for 4G services and applications in five years’ time. We also develop a model identifying the challenges as well as opportunities for the national players in the mobile communications sector, i.e. for the operators and content developers. The results indicate that the main source of service innovation is likely to come from combining knowledge of a country’s local perspective together with that of the global trend of mobile service applications. The combination of both streams would create a new service which is likely to be swiftly adopted by the market.

Introduction

The evolution of mobile technology has emerged as a series of incremental innovations, from 1G (first generation) to upcoming 4G (fourth generation). Streams of technological innovation, followed by the diffusion process of new services, may subsequently produce a new form of actions and responses by the market as well as by the industrial players in a country. Beginning with voice as the main commodity since the first mobile generation, SMS has appeared as a value-added service in the 2G era. This innovation in text messaging services was globally adopted by the market indicating a prominent and unplanned success story in mobile services. However, in the era of 3G, video calls, as one of the predicted killer applications, failed to achieve success in the global market. Meanwhile, the capability of 3G to support Internet access has enabled the delivery of many mobile service applications over data services.

What about the diffusion of service applications in the era of 4G? Since the technical implementation of 4G has not globally arrived, we can only search and predict the 4G-related services. Using the framework of technological innovation management, this research tries to formulate the characteristics of mobile service innovation which would be successfully diffused in the prospective market of 4G era. It is believed that current mobile subscribers may give an indication of specific demand for the future 4G services. Should the industrial players direct their actions to providing services to the market, they can learn and develop the capacity for responding such a market demand.
The objective of this study is to formulate the characteristics of the upcoming 4G mobile service applications which might be diffused in the Indonesia market. To answer this objective, this study has conducted a survey in the Indonesian market. Subsequently, the analysis also tries to identify the opportunity for industrial competitiveness in Indonesia. It is in line with our previous publication explaining how the coming of 4G may bring opportunities for innovation in Indonesia (Suryanegara 2011).

This paper is structured in six sections. The second section reviews the underlying theories including technical understanding of 4G mobile technology and a general innovation framework. The third section presents the mobile technology ecosystem in Indonesia. The survey’s design and its results are explored in the fourth section. The fifth section discusses the innovation challenge and opportunity, while the conclusion is presented in the last section.

**Underlying Theories**

**4G Mobile Technology**

Mansell (1998) and Fransman (2002) have denoted communications technology as a pervasive technology which has the potential to change very radically the foundations of society, and moreover has supported the engine of innovation. Many scholars have argued that communications technology in general can be classified as a General Purpose Technology (GPT), concerning its general pervasiveness and its ability to increase innovation in other technological sectors. As part of communications technology, mobile telephony (sometimes called cellular telephony) has become the dominant market sector and surpassed the fixed line market. Considering its rapid trend and high adoption rate, mobile telephony has been an alternative platform for providing society with communications tools (Suryanegara and Miyazaki 2010a). Mobile technological innovation has also provided cost-effective ways for developing countries to increase basic ICT penetration in rural areas.

The evolution of mobile technology begin with the analog 1st Generation (1G), followed by the digital 2G (including SMS capabilities), then the multimedia-supporting 3G (officially called ITU-2000 standards). In the 2G market, GSM development in 1992 had succeeded in covering almost the whole of Europe with a single standard, while the two most popular 3G standards, iCDMA-2000 and W-CDMA, have subsequently dominated the global market. An ITU Report mentions that the Asia-Pacific region added the most 3G subscribers, while Europe, the Middle East and Africa grew the fastest (ITU 2007). Table 1 shows the evolution of mobile technology in which each generation has its main technical characteristics applied on particular regional or global technical standards.

At present, the advances in 3G networks have been applied through the implementation of several related technologies, such as HSDPA, EVDO Rev B as well as WiMAX. Such schemes were designed to bridge current networks to the upcoming 4G platforms. ITU has defined 4G technically under the IMT-Advanced specification; which includes the new capabilities supporting low to high mobility multimedia applications and a wide range of data rates in accordance with user and service demands in multiple user environments.
| Standards (major country use) | 1G | 2G | 3G | 3.5G – 3.9G | 4G |
|------------------------------|----|----|----|-------------|----|
| AMPS (America, Australia)    | Analog | Digital (able to support SMS, digital encryption, spectral efficiency) | Defined by ITU IMT-2000 (able to support multimedia services on rate 2 Mbps) | Act as the advancement of 3G network supporting the data rate more than 2 Mbps | Defined by ITU IMT-Advanced (able to support 1 Gbps on low mobility) |
| NMT (Nordic countries)       |    |    |    |             |    |
| TACS (UK)                    |    |    |    |             |    |
| C-450 (West Germany)         |    |    |    |             |    |
| GSM (mostly used in Europe, Latin America & Asia) |    |    |    |             |    |
| IS-95 / cdma-one (mostly used in North America) |    |    |    |             |    |
| PDC (Japan)                  |    |    |    |             |    |
| PHS (Japan)                  |    |    |    |             |    |
| W-CDMA (mostly used in Europe, Latin America & Asia) |    |    |    |             |    |
| CDMA2000 (mostly used in North America) |    |    |    |             |    |
| TD-SCDMA (China)             |    |    |    |             |    |
| WiMAX / IP-OFDMA             |    |    |    |             |    |
| HSDPA                        |    |    |    |             |    |
| HSUPA                        |    |    |    |             |    |
| EVDO Rev B                   |    |    |    |             |    |
| LTE Release 8                |    |    |    |             |    |
| LTE-Advanced                 |    |    |    |             |    |
| WiMAX 2                      |    |    |    |             |    |

Table 1 – Evolution of Mobile Phone technology

In 2011, the International Telecommunications Union named LTE-Advanced and WiMAX 2 as 4G technological standards since they were able to achieve maximum data rates up to 1 Gbps as required by IMT-Advanced. Despite these technologies being new, many analysts have predicted that most existing operators will follow a seamless migration towards LTE-based preferences. LTE appears as a promising de-facto standard since it was designed to co-exist with earlier 2G and 3G networks including GSM, W-CDMA and HSPA+ standards. It is also predicted that a global QoS architecture for multimedia traffic in mobile heterogeneous environments is essential, able to support multiservice, multi-operator environments handling complex multimedia services with per-user differentiation (Marques 2003). Such an upcoming 4G’s situation has led to a strategic consequence signifying advanced-service applications (Suryanegara and Miyazaki 2010b, 2010c).

Previous Studies

As mobile communications technology is a complex system, its analysis should consider many factors ranging from social to technical ones. Once a technology is applied in a country, it needs to meet social political factors related to that country, and no longer to be confined to only technical issues. Hence, the regulatory framework in any country is very dynamic and concerned to address both technical and non-technical pillars, framed by the country’s telecommunications legislation. For example, almost two decades ago, market competition started to become a major concern. In response, the USA’s telecommunications deregulation in 1996 indicated the government’s willingness to break free from regulating prices on its monopoly carriers. On the other hand, a country like Indonesia has regulated service operators to spend a minimum of 35% capex and 50% opex on national production, in order to support local industry deployment (Kominfo 2008).

Regulations were introduced to encourage competition with the purpose of ultimately increasing efficiency and social benefits (Flacher 2008). Any national government may play a significant role in the communications infrastructure development in order to to increase the economic growth of the country. It is believed that the a country’s telecommunications policy can determine the performance of its overall economic welfare. Frieden (2005) has listed several actions by which a government can ensure that infrastructure development occurs for achieving better economic performance. Some of these actions are developing a vision and

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strategy, promoting digital literacy, fostering facilities-based competition and creating incentives for private investment and disincentives for litigation and other delay tactics.

Meanwhile, researchers had also done significant work questioning which standards will win in the 3G market (Saugstrup 2006). In liberalised markets, a network operator might have the freedom to provide services utilising any appropriate technical technology standard. When the issues expand into government authority on spectrum allocation, the chosen standard will have significant impact on the operator’s strategy. Hawkins (1998) has noted how in establishing a technology standard, laws and regulation can vary with practice and custom. In 3G cases, most countries have faced options in choosing a standard, dominated by the battle between WCDMA and CDMA2000.

Under the perspective of innovation systems, the theoretical concept notes that socio-institutional frameworks influence technical and structural changes. The introduction of new technologies may lead to a country’s competitiveness and industrialisation. Perez and Soete (1988) argue that significant efforts should be made to open such windows of opportunity. Relevant to that conceptualisation, Suryanegara and Miyazaki (2012) have proposed a framework to open windows of opportunity to the next generation of mobile technology. They discuss an opportunity for developing countries to develop any related technologies which may support the service performance of 4G mobile technology. The perspective of innovation building is a framework for seeing new technology as a way to trigger fruitful science and technology (S&T) activities, as well as research and development (R&D) activities under the platform of a National Innovation System.

**Indonesian Mobile Technology**

Indonesia is the fourth largest market in the world, having 17,000 islands of which 6,000 islands are inhabited. Indonesia has GDP per capita of US$ 3,900 p.a. of which 45.6% is generated from industry and 40.8% from services. Most of the labor force is occupied in the agriculture sector, where 42.1% of the workforce contribute to 13.5% of GDP. Indonesia is the largest island country in the world by population, most of which is concentrated in Java, making it the highest density island with around 900 people per square kilometre. Outside the oil and gas sectors, Indonesian electronic manufacture sits as fifth largest after the palm oil, iron, textile and rubber industries, contributing 6.3% of total export values. However, most of the electronic industry produces consumer products; telecommunications equipments depends heavily on import. Figure 1 illustrates the population distribution in the country.

Indonesian telecommunication regulation was structured under Act no. 36/1999, declaring the government’s motivation to control and regulate the sector in order to increase the nation’s prosperity. The Act also emphasises an anti-monopoly mission, directed toward market competitiveness. The telecommunications sector’s regulations are conducted by the Directorate General of Post and Telecommunications (DGPT), a division of the Ministry of Communications, in parallel with a semi-independent regulator body, called BRTI (Indonesian Telecommunications Regulation Bureau). However, only DGPT has authority to authorise any legal regulatory product while BRTI tends to focus on consumer protection issues (BRTI 2008). As a developing country, Indonesia’s regulatory framework was mainly motivated to increase teledensity, to foster market competition and to diffuse ICT applications leading to society empowerment.
The fixed-line services are monopolised by the incumbent national operator, *Telkom*, which has only 8.6 million subscribers (3% of national penetration). The company experienced negative subscriber growth in 2007, making the operator focus more on its data and multimedia business. In fact, this telecommunications company contributes dividends to state-coffers of around USD 1.1 billion pa, second only to the contribution made by the state oil company (Suryanegara and Miyazaki 2010a).

Despite the major economic crisis in 1998, the mobile market in Indonesia has experienced an exceptional run of boom years giving a subscriber number of about 180 million users out of 240 million in total population. The country has followed a complete mobile technology evolution, from 1G, 2G to 3G, in which the country applies both cellular technologies GSM and CDMA. The mobile cellular services began in 1990s, when several operators were given permission to enroll AMPS services, followed by GSM 900 MHz with licenses granted to three national operators namely *Telkomsel*, *Indosat* and *XL-Axiata*. In 2002, a CDMA technology-based network was adopted for supporting fixed-wireless access operators on the basis of a limited cellular licence. Subsequently, in the middle of 2006, the country launched a 3G network by adopting WCDMA technology as the official standard. The 3G licences were given to five operators, which had previously adopted GSM as their 2G standard. Hence, by the year 2008, there were 11 (eleven) mobile telephony operators of which five have operated GSM as well as WCDMA, and six operators are using CDMA technology.

Currently, the 3G market leader is *Telkomsel*, followed by *XL Axiata* and *Indosat* respectively. As an operator that has taken advantage of early market entry, *Telkomsel* has enjoyed 43% of national market penetration, serving around 80 million subscribers. However, at the same time the Indonesian mobile operators have been busily positioning themselves, since the voice market penetration is almost saturated. As a result, the operators have started looking for revenue from data services.

The Indonesian market is characterised by the strong domination of prepaid services (97% of national subscribers) and the open handset market; which means that subscribers can easily buy a handset without bundling it with the operator’s other services. Consequently, the market is fully loaded with many types of handsets, ranging from low-end terminals to ‘smart phones’. This situation is mainly due to a social perception that prepaid services, as well as an unbundled service, are ‘cheaper and affordable’. The above mentioned study by Suryanegara and Miyazaki (2010a) has also reported that Indonesian operators place importance on building a ‘cheap’ image in the perception of their subscribers. As a result, the operators prefer to offer mass-oriented products, added to the perception of being cheap.

In the era of 2G, Indonesian operators applied an aggressive tariff plan for basic services (voice and SMS) in response to tight competition amongst GSM-based and CDMA-based operators. The operators’ strategies also focused on providing value-added services, with a range of tariff plans and service customisations. Subsequently, in the era of 3G, despite
operators’ low sales volumes of content applications, the data card utilisation (using 3G access to connect the Internet to a PC or laptop) is rising significantly. As the data services start to be prominent in the era of 3G, the operators’ strategies have also incorporated the choice of service-delivery platform. By referring to an earlier study by Suryanegara and Miyazaki (2010a), we can summarise the Indonesian operators’ strategic perspective as shown in Figure 2.

We indicated in that study that Indonesia has a weak mobile telephony manufacturing industry. Initially, the R&D of the telecommunication industry was carried out mainly in two state-owned companies, Inti and LEN, and several private firms. Unfortunately the Asian monetary crisis in 1998 had a significant impact: most of the Indonesian telecommunication manufacturing industry went bankrupt. In the case of mobile technology, many operators are now entering the market with intensively imported technology. Under a ‘turnkey-based’ cooperation with foreign technology suppliers, Indonesian operators were encouraged to deploy national networks rapidly in which payment to the vendors is made upon the full installation and integration of the infrastructure. Such a business model gave advantages in performing rapid network deployment, but also led to strong technical dependency on foreign technological suppliers. Meanwhile, local telecommunication manufacturers have lost their competitiveness. UNAPCICT reported that total investment by ICT manufacture in 2006 was USD 360.8 million, in which only 5.2 % was local investment.

| Evolution          | 2G | 3G and beyond (towards 4G) |
|--------------------|----|---------------------------|
| **Year**           | 1997-2003 | 2004-2005 | 2006- beyond |
| **Market creation**| Operator drives the market | Commercial driven |
| **Operator focus** | Responds to financial crisis | Increasing revenue, profit-seeking |
|                    | Network deployment | Utilizing established infrastructure |
|                    | Grab new subscribers | Retain subscribers |
|                    | Prepaid services | |
|                    | Postpaid services | |
| **Service core as source of revenue** | Basic services : Voice and SMS | Value Added Services | Data |
| **Service-selling strategy** | Sell basic services | Maintain prepaid subscribers | Tariff plan |
|                    | Service customization | Wholesale (Service delivery platform) |

Figure 2 - Summary of strategic perspective of the Indonesian operators (Suryanegara and Miyazaki 2010a)

The operators’ dilemma and the survey design

The operators have faced a dilemma in anticipating 4G technology. Since most applications run over data, any parties can join the industrial ecosystem and take a benefit from the market. The operators will generate revenue only from selling the network, while they still have to spend money on building the physical infrastructure. Meanwhile, the data tariff is getting low and the regulator has pushed the market to provide fair competition. Services supporting a modern life style are highly anticipated, but there is no guarantee every application will be successful in the market. The role of the market is getting stronger, prompting specific features in 4G applications. Therefore, the operators need to develop an appropriate service application strategy, matching with market expectations. For that reason, they need to
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understand the specific demand and behavior of the Indonesian market, so they can develop a strategic response.

The survey of market demand we carried out was motivated by two perspectives. Firstly, the survey was designed to understand the subscribers’ behavior in using mobile services; and secondly, it was designed to capture the specific market demand for 4G services. By using a general statistical formula, giving a level of confidence 95%, level of precision 0.08 and proportion 75%, the survey population number has targeted N=113 respondents living in Jakarta. It is believed that since Jakarta is the capital city of the country, it may represent (or lead) the general trend in customer behavior as well customer heterogeneity.

It was found that 69% of total respondents are in the youth segment (age 15-25 years old). Given the expectation that 4G will be implemented in the coming five years, this sample will serve the main assumption, that such respondents will be the main market subscribers within the coming years. It is believed that the small sample of respondents is representative of the likely population of users of mobile services in Indonesia in five years’ time. It was found that the majority of the sample (51%) spends between 100,000 IDR and 250,000 IDR on communications expenditure, which is equal to 10% of individual monthly expenditures. A simple implication can be inferred, that 4G operators should not offer service tariffs above 10% of subscribers’ monthly expenditure.

It is argued that the sample of respondents in Jakarta is representative of the Indonesian market, because:

1. Jakarta is the centre for life styles and modern trends which subsequently are followed by other provinces in Indonesia,
2. Typically, the national operators launch their latest services and products in Jakarta, and penetrate in other service areas afterwards.
3. Despite the heterogeneity of the country’s demographic profile, 65.7% of the population in Jakarta is Javanese. This proportion is similar to the main distribution of population in Indonesia.
4. Some 70% of the Indonesian money-supply is located in Jakarta. The term money-supply refers to the amount of money available in an economy.

The profile of the sample of respondents matches relatively well with the general Indonesian demographic profile. The evidence is:

1. Some 69% of respondents are in the age group of 15-25 years old, which means, they will be in the age group of 20 – 30 years old within five years’ time. It is linear with the actual trend in Indonesian demographic data, in which the age group of 15-64 years old is always in the level around 65% to 70%.
2. The sample consists of 60% male respondents. The actual Indonesian population consists of 51% male population while the sex ratio of male at birth is 1.05 male/female.
3. The sample indicates 58% of respondents are students, which means, they will be part of Indonesian labor force when 4G is implemented in the coming five years. This is consistent with a fact that the trend of Indonesian labor force is in the level around 50% to 60%.
4. The sample indicates 47% of respondents have purchasing power of less than 150 USD per month. Meanwhile, the national economic data has also indicated that 50.2% of Indonesian population has the purchasing power of 2 USD – 6 USD per day. The term “purchasing power” refers to the ability of a person to spend an amount of money for daily or monthly expenditure.
Capturing Subscribers’ Online and Offline Behaviour

The first objective of the survey led us to identify important information regarding subscriber behaviour. We categorised this behaviour into two scenarios: online (connected to cellular service) and offline (accessing the solely offline features in the handset). We asked the respondents to make a priority list of the applications they accessed. It is not a very surprising result that the majority of subscribers are using their handsets to make voice calls, SMS, chatting, emails and use social media. It was found that 14% of handset users listed voice as the top priority communications applications. Another 14% of users listed SMS as their most-accessed application; 12% listed social media; and 11% listed email as their main service.

An interesting result is that the ‘handset clock’ has become the offline feature which is most accessed by users, i.e. the handset provides the function of a wristwatch to indicate the time. Subscribers also use their handset as an electronic organiser, setting the alarm as well as scheduling their agendas. 14% of users use the ‘clock feature’ as their main off-line application, followed by the phone’s camera (13%) and electronic organiser (10%). At lower frequencies, it was found that handset users also use others offline applications, such as games, document readers, video recorders and audio services.

What can we infer from such facts? It leads to a significant hint to operators as well as to content developers that the upcoming 4G applications should be something relevant to timing and scheduling. However, typical mobile-based applications are designed for working on handsets as the only hardware platform; they need an additional interface or device to support advanced service performance. For instance, if a user has been scheduled to do some sport in a room, the supporting device may be embedded in the handset (such as a device to monitor the room’s oxygen level and a device to monitor the user’s heart-rate). Therefore, the relevant applications should not only work on handset-bases but also be embedded in another device (embedded hardware).

Users’ Expectations of 4G

The survey’s second objective was to capture service expectations for the prospective Indonesian market. The survey questionnaire was formulated by conducting expert panels, in which panel members were requested to list the most likely subscriber handset-related activities during the 4G era. Panels were composed of people who have had experience in the national mobile industry. We developed two sets of questionnaires in which the first one stimulates respondents by suggesting a scenario of offered activities, assuming 4G is already implemented. The target is to construct prospective market responses by simulating their activities during the 4G era. A set of activities was proposed, and respondents answered YES or NO as shown in Table 2.
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Table 2 - The market response based on respondents’ responses to the offered statements

The results in Table 2 indicate that a majority of users (71%) will keep utilising SMS despite the higher data capacity of 4G. However, there is also an indication that online chatting facilities have started changing subscribers’ behavior. Around 40% of prospective users are showing eagerness to utilise new services more than SMS. Almost all prospective users (94%) are concerned about connection availability. They indicate a strong expectation that mobile networks should reach them, as users, anywhere and anytime.

Concerning voice services, 81% of respondents have indicated a strong request for better voice quality. This result should be wisely understood by operators, given that the Indonesian market still regards voice as the main commodity. We also questioned the perception of prospective users regarding the Internet-based VoIP service. Only a minority of respondents (19%) have indicated a firm rejection of utilising VoIP more than voice, while a majority have exhibited willingness. This signifies another challenge to operators: if they provide a standard voice service, they will need a proper strategy to compete with VoIP services.
Regarding the 4G service applications, the survey produces an interesting finding: that 83% of users expect a new application, which presents a challenge as well as an opportunity for operators to design new types of service. Interestingly, it was found that the Indonesian market is not interested in watching TV on their handsets (42% of respondents say NO, while 34% say MAYBE). There is also a sign that despite the popularity of the PC Tablet, the market is still wanting to use a mobile handset. In addition, the market shows a trend similar to current 3G market behavior, in that a 4G SIM Card would be used in their laptop.

We also try to understand the pattern in market responses to the various kinds of 4G service applications. The questionnaire listed several 4G services, in which some are believed to start appearing the future, and some are already growing at present. The respondents were requested to choose one of four options (very eager, eager, still doubtful, reject). We mapped the respondents’ choices into four domains as shown in Figure 3.

**Figure 3** - The map reflecting the predicted response of the future Indonesia market

Referring to Figure 3 in Domain 1, a majority of users have indicated eagerness to adopt several major services, including applications supporting a subscriber’s duty or job. The simplest example of this feature is to provide a daily agenda. This is consistent with our earlier finding that subscribers use their handset as their “personal assistant” to schedule their daily agenda. In fact, it is not a new concept: Suryanegara and Miyazaki (2010b) pointed out that Japanese operators have been offering mobile services to support life-style applications as well as ‘life style infrastructure’ in the Japanese market since the beginning of the 3G era.

Another application listed in the first domain concerns health-related services. The expert panel has specifically listed such services since they were believed to be a prominent 4G application. As part of the popularity of smart phone, some applications support diet programs as well as sport activities. We point out a finding that is particularly characteristic of the
Indonesian market. It is believed that the Indonesian market would be very eager to adopt several applications which are related to the country’s conditions. As Jakarta is one of the busiest and biggest cities in Asia, the experts believed applications which are 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 criminal indicators. We signify this fact as an important one since the prospective market is concerned with feeling secure, not just its security applications.

In Figure 3, Domain 2 refers to services which would also be eagerly adopted but not as strongly as those in the first domain. These include services related to family and educational topics. They include service applications to foster a subscriber’s recovery when one has a particular illness. Such applications may be developed by considering the R&D possibilities with sensors and embedded devices. For example, someone who suffers from hypercholesterol may try to reduce the cholesterol level by doing sport or consuming medicine. Therefore, a programmable software application to monitor subscribers’ physical activity using an embedded sensor regularly measuring cholesterol levels may help them.

The prospective market would also adopt services related to vehicles, such as GPS maps and traffic reports. Similarly, there is interest in services to support economic and trading activities. Such applications are not something new, as they have emerged in recent years as part of the popularity of 3G. An interesting finding is about subscribers’ concern with family growth. It appears that the future market has a special segment concerned with their children. An innovation opportunity may arise, in which service applications such as child surveillance, as well as control of Internet contents, would be eagerly adopted. Meanwhile, as the world’s biggest Muslim country, the Indonesian market is also eager to adopt services which are in line with faith and religion. For example, since the 2G era, the Indonesian operators have already launched innovative applications during Ramadhan (the Moslem holy month) facilitating subscribers’ special religious commitments. It also shows how the Indonesian operators have tried to satisfy demand for the majority of their market.

Referring to Figure 3, in Domain 3 a majority of users have a hesitancy in adopting any application which provides a news update of Indonesian political and social conditions. Meanwhile, the empty list in Domain 4 indicates no application is firmly rejected.

Discussion

Opportunity and challenge

By analysing the overall results, we may formulate the 4G applications which are needed by the Indonesian market. A core finding is that there is no single application which is very likely to be widely adopted, the so-called ‘killer application’. An indication can be seen in Figure 3, where despite the difference in adoption preferences, a wide range of applications are of interest to prospective users. There are various types of applications which might be offered, ranging from health-related services to daily-scheduling agenda assistance. Meanwhile, the domain preference can be used as guidance for developing priority services for the Indonesian market.

The previous study (Suryanegara and Miyazaki 2010b) signified the importance of a service-driven perspective in the era of 4G as well as the importance of a coupling mechanism in service innovation. It is important to provide services which are built by embedding 4G mobile technology with other supporting technologies. The general implication is that 4G would emerge as an advanced service application which integrates several technological platforms. In the development of mobile health applications, sensors would need to be integrated in the interface between a person and a machine (Suryanegara and Miyazaki 2012). The survey results suggest that some more complex applications would be eagerly adopted by users.

We consider the service innovation framework, as Tether and Howells (2007) argue that innovation provides the source of new technology. In the case of mobile technology, service
innovation has started to take a significant role where the coming of 3G has enabled multiservice creation. It affects the strategic perspective of operators, in which innovation in service is becoming crucial for success (Suryanegara and Miyazaki 2010c). Meanwhile, the introduction of new services will not always be automatically accepted by the supply side in the competitive market. They require value propositions that should be defined by considering the prospective market itself. Using this approach, mobile technology development can enable the creation of new services that will be taken up. Operators will learn and adapt to the market, while knowledge is generated to support market expectations. Thus, this methodology can lead to an opportunity for operators to develop various kinds of 4G applications which may match the demand side of the personal mobile market.

Another underlying consideration is to note the general findings that there are two streams of prospective 4G services expected: traditional mobile services which are already implemented (including voice and SMS), and services which can be categorised as new kinds of applications. Hence, the survey also conveys an important message: that the Indonesian market is expecting such new applications. The question is who is going to provide these applications? With the coming of data services, the market no longer relies on national operators or local providers, because new applications are provided and are operated within the global cloud (i.e. utilising hardware and software resources elsewhere in the Internet). The virtual borderlessness of cloud data services has enabled the national market to utilise applications developed outside the country. Inevitably, national operators have also started shifting their functionality from network service provider to merely network provider (simply called the Over The Top business model). For example, the earlier finding indicated that 46% of respondents would utilise VoIP rather than normal voice telephony. As a consequence, this may lead to a serious threat which may harm operators’ traditional voice service revenue.

The local innovation perspective

We argue that the coming of 4G mobile applications leads to innovation challenges as well as opportunities. Concerning the innovation opportunities, Suryanegara and Miyazaki (2012) suggest that the policy makers should foster science and technology activities in several emerging research areas. The strategy for opening up innovation opportunities is based on the technical characteristics of 4G. This strategy is designed to foster a country’s competitiveness by focusing on national research activities. In the case of the Indonesian market, this strategy can be formulated by identifying windows of opportunity from the results of the survey. The logical sequence begins with ‘the prediction of 4G services’ characteristics’ based on the Indonesian experts’ opinions (as listed in Figure 3). Since Indonesia has not started the implementation of 4G services, these opinions refer to the experts’ understanding of 4G technology and its global technological trend. Consequently, the results of the survey are based on these experts’ assumptions as to the extent to which the Indonesian market would follow the global trend of 4G services.

By linking with the findings in Figure 3, it is pointed out that the Indonesian market demand would be relatively similar to the global trend in 4G services. Meanwhile, the innovation opportunity appears from 4G applications when it is matched with the Indonesian situation. For example, the findings indicate users’ eagerness to adopt 4G applications which may increase ‘health quality’. But when 4G applications are adapted in Indonesia, one should design mobile-health application to suit the characteristics of the country. Indonesia suffers from many endemic tropical diseases, including typhus, malaria and dengue fever. In this case, the national industry should conduct R&D collaboration with local medical researchers to develop relevant mobile-health applications.

We have recommended that the design of 4G services should attune the global trend to the target country’s specific characteristics. How do we incorporate the local-innovation perspective into a specific 4G service? Figure 4 proposes a model for incorporating the local innovation perspective into the design of service applications for the upcoming 4G Indonesian market.
Figure 4 - The innovation perspective of the future Indonesian market

Figure 4 shows that the main sources of 4G service innovation may come from contributing a local-innovation perspective as well as the global trend, and that the combination of both perspectives can be supported by the 4G technology platforms. The reality is that development of service applications will normally be conducted by the national industrial players, in particular the 4G operators and the content developers. Since the Indonesian mobile market is quite mature, we can expect a strong market influence to push the national industry to fulfill the upcoming demand for 4G services and adaptive the global trends to local-specific demand.

As a developing country, Indonesia needs growing systems and synergies to achieve fast growth based on interrelated technological dynamism. Consequently, the national industry needs to acquire knowledge for the development of 4G service innovation. To achieve this knowledge transfer, the national industry should set up a strong collaboration with other knowledge creators, including university and public research institutes. In addition, it is believed that 4G services will run on the basis of synergies between several technological platforms. For example, mobile-health applications will be enabled by the simultaneous evolution of smartphones, network infrastructure and related supporting devices. Consequently, the industrial entry barrier is becoming lower, since any related technology producers can contribute to the development of these service application.

The national industrial players enjoy a significant advantage: a deep understanding of the local market characteristics. Hence, the Indonesian industrial players should perform ‘early entry’ in the 4G market to gain early take-up and initial market control. In addition, proper science, technology and innovation policies, as well as political commitment, should be made by the policy makers to ensure the development of service applications based on preference for a local-innovation perspective.

Conclusions

We have developed a framework to assess 4G-mobile service applications and have provided perspectives concerning innovation challenges and opportunities. By using a survey targeting the Indonesian market, we found the characteristics of 4G service which would be most likely to be adopted by the prospective users in this developing country. It was found that there is no single feature which is likely to become a ‘killer application’. Consequently, the national industrial players should take the opportunity to develop various innovative applications based on the local-innovation perspective. It relies on understanding the Indonesian market
behavior, including the likelihood of prospective users adopting 4G services which support their activities and duties, and which will improve the quality of their health.

Since most 4G applications will run as data services using the Internet, there is an innovation challenge for national players to compete with global service developers. This may be a challenge for the network operators, as they will be threatened with being left as infrastructure providers and not as applications providers as well. On the other hand, the innovation opportunity is wide open, as long as the national players pay attention to market behaviour. The national industry needs to be able to understand the specific market demand for future 4G-based services, and subsequently develop the relevant services for the Indonesian market.

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1. By definition, a GPT (general purpose technology) is a technology or technique that has the potential to have an important impact on many industries’ economic performance (Guerrieri, and Padoan, 2007). Guerrieri and Padoan (2007) mention the key characteristics of GPT: pervasiveness (used as inputs by many downstream industries), technological dynamism (inherent potential for technical improvements) and innovation.

2. Initially, the development of LTE started in 2004 by 3GPP, a collaborative group which developed the 3G-WCDMA standards. LTE is proposed for a full Internet Protocol (IP) network architecture and is designed to support voice and high-speed data access. The specification of LTE Release 9 was established in 2009, focusing on enhancing the HSPA+ networks. Subsequently, LTE Release 10 was developed as the next generation of LTE, matching with 4G requirements. In fact, by focusing on empirical studies, Govil and Govil (2008) have identified several engineering key technologies of 4G.

3. In Indonesia, the technology of fixed-wireless-access (FWA) works on the basis of CDMA. The technology is slightly different to mobile cellular, as FWA provides wireless access to the Public Switched Telephone Network. In 2002, the Indonesian basic telephony penetration was very low (3%), which caused FWA to be chosen to cover remote areas. Hence, the year 2002 became a starting point of CDMA technology penetration in the Indonesian market. In parallel, due to weakness in technical performance, AMPS was overshadowed by GSM domination, and most AMPS operators moved their network platforms to CDMA. The latest regulation in 2010 has changed the CDMA’s limited-mobility license into a full-mobility cellular license. Currently, TelkomFlexi has the biggest CDMA-market share with 15 million subscribers (9% of national penetration), followed by Bakrie Telecom with 9 million subscribers.
