Harmonizing Government Policies and Enterprise Strategies for IoT Business

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Abstract: What should government and enterprises prepare for the era of Internet of Things (IoT)? And what are the key factors impacting success of IoT business? To provide valuable insight for these questions, we have investigated potential implications of IoT and compared the market and technological status of IoT. The result of the analysis reveals that developing fundamental source technology and securing intellectual property rights are the key success factors for business enterprises in achieving global competitiveness. Moreover, government policy should be harmonized with business strategy of enterprises to improve reliability of product and service from enterprises globally. We believe these results will provide novel implications for both business enterprises which are preparing IoT business and government policy to support growth of IoT industry.

Key-Words: IoT (Internet of Things), Enterprise Strategy, Government Policy, IoT Business and Industry

1 Introduction

The importance of the Internet of Things (IoT) is reflected in the Information & Communication Technology (ICT) industry throughout the events such as the CES, MWC, and IFA of 2014. IoT is an intellectualized sensory and intelligent manner emerged under the internet network through the interaction of devices and people. Furthermore, the convergence of IoT with smart devices, cloud, and big data is expected to establish a hyper connected society [1].

Gartner’s top ten strategic technology trends, as seen in table 1, presents a set of creative innovation that have the eminent potential to bring about an influence to the industry. Moreover, Gartner predicts that the commercial value of the IoT will be predominantly displayed by the global research government. Through the speculations and the amount of attention the IoT received this year at the CES (Feb 2014), MWC (March 2014), and IFA (Sep 2014) IoT is identified as a valuable key word. Various products and services associated with the IoT are conceptualized and integrated to the market.

The number of devices connected to the Internet through the IoT technology is expected to increase [2]. IoT is also expected show a financial ripple effect by the commercial growth of 21 percent by 2020. In 2013, the market was estimated to be worth twenty-six billion dollars, but it is expected to increase to a nineteen trillion dollar market. Currently, the devices connected to the internet is estimated to be less than one percent, which allows us to estimate the destructive innovation the IoT technology will bring forth to the commercial industries when the hyper connectivity environment is established [2,3]

IoT is forecasted to bring about a significant change in the countries with leading IoT technologies such as the U.S., Germany, and Japan. Google and Cisco are the leading ICT organizations that have already attempted to enter the IoT industry at the forefront.

The Ministry of Science, ICT and Future Planning is a ministry of the Government of South Korea. After evaluating the strategy for South Korea, the ministry has set agenda to commercialize and mature the industry. SK Telecom and Samsung Electronics have shared their visions of the IoT through their launched products and services. Despite the high potential to produce a market focused towards the ICT with an excelling ICT infra, the smart and medium size enterprise in Korea have refrained themselves from participating in the market. Also the limited sources of innovation in the hardware market have made it difficult for the sensor, platform, and solutions to implement the IoT technologies.

This paper analyzes the various ideas and strategies that the enterprises in Korea must pursue to expand their engagement and participation, while...
forecasting and developing products and services that will allow them to compete and commercialize in the global IoT market.

2 Meaning and Potentials of IoT

2.1 Meaning of IoT

In the year 1999, Kevin Ashton, the founder of the Auto-ID Center in Massachusetts Institute of Technology (MIT), first found the term IoT. At the time, RFID and the sensors utilized throughout the daily activities were acknowledged as the “Internet of Things”. Since then the notion of the IoT was established in 1999, the World Summit on the Information Society (WSIS) and International Telecommunication Union (ITU) have mentioned the network patterns between the devices and people and studies leading to the standardization of the technology.

As depicted in Fig.1, the report indicates the IoT as, “Anytime, anyplace connectivity for anyone, we will now have connectivity for anything”. Simply put, the IoT is defined as being able to connect a device or individual at any given time in anyplace through anything. The thing defines the sensor and sensory aspects of tagging things, thinking things, and shrinking things [1]. The people, objects, space, and data connected to the internet helps create, collect, and share these data, which establishes the Hyper connected environment[5].

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Recently, the ITU defined the IoT as an information technology for the information society that enhances both the virtual and physical services to provide a global infra [5]. On the other hand, CASAGRAS, a European Union (EU)’s research and development project, justified the IoT as a global network infra that collects data to connect the virtual and physical devices [6].

Hence, the IoT isn’t simply the expansion of devices connected to the internet, but it is the technology augmentation of network connected between devices and devices, people and people, devices and people. Thus, the connections symbolize the entrance of our network to a hyper connected society. The augmented network initiates a hyper connectivity that attempts to act as the “Network of Network” [7].

2.2 Potentials of IoT

The development of the internet began since the 1960’s, which was initially developed for military purposes. Since then, the internet have grown to become one of the most disruptive and valuable innovation that have grown into an infra to help connect the world. The human history faced a turning point after the implementation of the internet.

In an effort to enhance physical productivity the agricultural revolution and industrial revolution took place, as such, the introduction of internet has brought about an information revolution that has drastically increased the value of both the creation and distribution aspects of the internet. Currently, the smart/Hyper-connected revolution have converged IoT, Big Data, and Cloud to overcome the limitation of physical, virtual, and space time to create a new change to the era (as illustrated in Fig.2).

As illustrated in Fig.3, the evolution of the internet reflects the changes in the IoT’s paradigm. After discovering the invention of the internet, the PC propagated during the 1980’s and 1990’s along with the expansion of cable infrastructures. Creating the PC’s internet connection has helped
propel internationalization and the mobile’s internet during the 2000’s. Recently, the internet infrastructure has redefined itself as the Internet of Things.

The internet infrastructure had served as a tool to connect and bring people closer. On the other hand, the IoT differs from the other internet infrastructure, as it expands to provide an interconnection not only between devices and people, but also between the physical and virtual space [7]. Furthermore, the devices connected to the infrastructure are an intelligence based network attempting to deliver a more intelligent and connect network that is expected to add more value.

The U.S. National Informatics Centre has forecasted that by the year 2025, IoT will be able to identify the locations of every individuals and objects. This technology is one of the disruptive technologies from the IoT that is currently in plans to be developed.

China has set the IoT as one of the emerging market and has made efforts to prepare for the market since 2010. In the year 2012, China has set 193 cities to implement IoT technologies to help expand the market.

Japan has developed various ICT related technologies to prepare for hyper connected society, since the early 2000’s. ‘u-Japan’ (2004), ‘i-Japan strategy 2015’ (2009), and ‘Active Japan ICT Strategy’ (2012) are some of the engagement that illustrates Japan’s participation to become the forefront runner of the IoT technologies.

The world leading companies are preparing for the changes that the IoT will bring. Google has purchased the Nest Labs, a home automation company, for over three billion US dollar. Hence, Google is preparing for the market by creating products and services relating to the IoT. Therefore, demonstrating a vision to expand and create a platform that unites products and services for the IoT. Cisco has shared a vision to define the IoT through the internet communication devices and cables. In an attempt to create an enhanced standard of lifestyle, Cisco will develop a smart connected community that will connect cities and people, while enhancing the people’s life style.

Samsung Electronics, a home appliance company, and Qualcomm, a bandwidth company, are collaborating to create chips to implement into devices that will strategically help augment the IoT technologies. Companies around the world are demonstrating an expansion to lead the global ecosystem for the IoT market.

The global IoT market was estimated at two hundred billion and is expected to grow to one trillion by 2020. An annual growth of 26 percent is predicted and the U.S. (20%) and China (17%) are expected to lead the overall market industry [9]. The

<table>
<thead>
<tr>
<th>Rank</th>
<th>Top 5 Countries</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>USA</td>
</tr>
<tr>
<td>2</td>
<td>(Republic of) Korea</td>
</tr>
<tr>
<td>3</td>
<td>Japan</td>
</tr>
<tr>
<td>4</td>
<td>UK</td>
</tr>
<tr>
<td>5</td>
<td>China</td>
</tr>
</tbody>
</table>
The Korean IoT market was estimated at two trillion dollar and is expected to reach twenty two trillion dollar. However, from an international market perspective the market share that Korea holds in estimated to increase from 1.02 percent (2013) to 1.74 percent (2022) [3]. Therefore, the development of creating the sources of technologies and activating the domestic market is vital areas that Korea will have to overcome. Yet, Korea’s IoT readiness is ranked at number 2 from the G20 nations, which indicates a potential for success [8].

The international IoT product and service market was estimated at 188 billion U.S. dollar and is forecasted to reach 369 billion dollar by 2020, while Korea’s market is expected to grow from twenty two trillion Korean Won to hundred two trillion Korea won between 2013 and 2022.

The device and product sector from the global IoT market expects the chip related market to show a substantial growth, while the module market is predicted to display a more significant growth in Korea.

The network sector from the international market will grow from 9.5 billion dollars to 29 billion dollar from 2013 to 2022. Korea’s market is expected to grow from 16 billion dollars to 700 billion dollars [10].

From the international IoT market the application and service sector, the vehicle telematics is estimated to hold the largest proportion with 42 percent. Yet, in the Korean market home appliance industries is expected to hold 43 percent and vehicle industries to hold 41 percent [10].

Application and service sector will have to adapt to traditional industries to quickly adapt and create services converged with IoT. Hence, the application and service area is expected to design a new market and business ecosystem.

The manufacturing equipment is deemed to have the most potential and growth, as the sector is expected to grow 2.35 as large in the internationally and 4.61 in the Korean market. The network sector is estimated to grow 3.06 internationally and 37.5 in Korea. The solution and system sector will grow 96.08 internationally and 132.81 in Korea. The application and service sector is forecasted to grow 322.91 internationally and 468.52 in Korea.

4 Assessment of IoT Industry

The research methodology is based on the studies of Lee et al. (2013), which have been conducted on the survey of government, industry, researchers to forecast the Korea market and trends. The studies are structured into technological sections, as such, hardware, software, network, and service divisions during the period when Korea that would initiate the IoT market. Furthermore, the preparations of the world leading nation’s technology and preparations are discussed in detail [11].

<table>
<thead>
<tr>
<th>Table 2 IoT Industry in Global and Korea [10]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Global Market ($100M)</strong></td>
</tr>
<tr>
<td><strong>2013</strong></td>
</tr>
<tr>
<td>Devices</td>
</tr>
<tr>
<td>Chipsets</td>
</tr>
<tr>
<td>Modules</td>
</tr>
<tr>
<td>Terminals</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Networks</td>
</tr>
<tr>
<td>GSM/HSPA</td>
</tr>
<tr>
<td>CDMA</td>
</tr>
<tr>
<td>LTE</td>
</tr>
<tr>
<td>Other</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Solution/Providers</td>
</tr>
<tr>
<td>Device Manufacturer</td>
</tr>
<tr>
<td>System Integration</td>
</tr>
<tr>
<td>Application Provider</td>
</tr>
<tr>
<td>B2B/B2C Service Provider</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Application/Services</td>
</tr>
<tr>
<td>Telematics</td>
</tr>
<tr>
<td>ITS</td>
</tr>
<tr>
<td>Smart Grid</td>
</tr>
<tr>
<td>FMC</td>
</tr>
<tr>
<td>Home Appliance</td>
</tr>
<tr>
<td>Other</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

The speculations for identifying the arrival of IoT related technologies and the market entrance of IoT are indicated, as Table 3. Majority of the responses replied that the commercialization of IoT will begin after 2016. The responses displayed similar views of the future forecast of IoT.

Classifying the technologies utilizing the value chain of IoT divided the technologies into four classifications, as such, hardware, software, network, and service. From prior studies we have based our studies on the U.S., Japan, Germany, United Kingdom, and France for the advanced countries.
Table 3 Korea’s Market Entry to the IoT Market

<table>
<thead>
<tr>
<th></th>
<th>Advanced Countries</th>
<th>Korea (ROK)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of Respondents</td>
<td>Percentile</td>
</tr>
<tr>
<td>Prior to 2011</td>
<td>1</td>
<td>2.3</td>
</tr>
<tr>
<td>2011 – 2012</td>
<td>3</td>
<td>6.8</td>
</tr>
<tr>
<td>2013 2014</td>
<td>1</td>
<td>2.3</td>
</tr>
<tr>
<td>2015 2016</td>
<td>19</td>
<td>43.2</td>
</tr>
<tr>
<td>After 2016</td>
<td>20</td>
<td>45.5</td>
</tr>
<tr>
<td>Total</td>
<td>44</td>
<td>100</td>
</tr>
</tbody>
</table>

From the experts who have participated in the survey, the U.S. scored the highest grades with hardware (84.1 percent), software (84.1 percent), network (50 percent), and service (59.1 percent). However, Korea has scored 25 percent in the network category, which indicated that Korea has a strong network service.

Table 4 Evaluation of the IoT Related Technologies

<table>
<thead>
<tr>
<th></th>
<th>Hardware</th>
<th>Software</th>
<th>Network</th>
<th>Service</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of Respondents</td>
<td>Percentile</td>
<td>Number of Respondents</td>
<td>Percentile</td>
</tr>
<tr>
<td>U.S.</td>
<td>37</td>
<td>84.1</td>
<td>37</td>
<td>84.1</td>
</tr>
<tr>
<td>Korea</td>
<td>1</td>
<td>2.3</td>
<td>2</td>
<td>4.5</td>
</tr>
<tr>
<td>Japan</td>
<td>5</td>
<td>11.4</td>
<td>1</td>
<td>2.3</td>
</tr>
<tr>
<td>Germany</td>
<td>1</td>
<td>2.3</td>
<td>1</td>
<td>2.3</td>
</tr>
<tr>
<td>UK</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>6.8</td>
</tr>
<tr>
<td>France</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2.4</td>
</tr>
<tr>
<td>Etc</td>
<td>1</td>
<td>2.3</td>
<td>2</td>
<td>4.5</td>
</tr>
<tr>
<td>Total</td>
<td>44</td>
<td>100</td>
<td>44</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 5 The Comparison of Korea to Advanced Countries

<table>
<thead>
<tr>
<th>Technical Classifications</th>
<th>Comparison of the Advanced Countries to Korea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware</td>
<td>(70.91) / 100</td>
</tr>
<tr>
<td>Software</td>
<td>(68.82) / 100</td>
</tr>
<tr>
<td>Network</td>
<td>(88.66) / 100</td>
</tr>
<tr>
<td>Service</td>
<td>(72.57) / 100</td>
</tr>
</tbody>
</table>

In order to gain a better observation of how advanced the countries, we have compared Korea’s technologies with the other advanced countries. The result indicated the network (88.66 percent), service (72.57 percent), hardware (70.91 percent), and software (68.82 percent). As shown in table 5, the networks infra have shown a high score, while the software, platform, and solutions have still shown a lack technological solution.

The global companies’ IoT platform and solutions have already entered the market, while Korea currently is only developing applications and services without any platforms or solutions. Hence, Korean companies should attempt to acquire new sources of technologies. Furthermore, the government should support the companies’ products and services to improve Korea’s reliability.

5 Conclusion

The entrance of a hyper connected society will allow IoT to be implemented in their lives that connects beyond the physical and virtual network. Extending the connection of devices and people to connect to other devices and people will help liberate the connection limitation. Furthermore, IoT’s convergences with other major industries are expected to help launch new products and services to drive new growth.

IoT will not only help drive new growth, but will also alter the business throughout the different industries. The global ICT industries have already set out visions of carrying out action plans to enter the IoT market. Korea’s Ministry of Science, ICT and Future Planning has made plans to help support the IoT business ecosystems strategies and plans.

After observing the Korean IoT market, we have discovered high potentials for creating the market. However, the lack of development to create platforms, key solutions, and technological sources is noticeable to other world leading companies. Therefore, the significance of the government’s support and companies’ herculean efforts to create applications and services is of great importance.

References:


