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The Fourth Industrial Revolution Age: Revisiting Entrepreneurship and Start-ups

Upon the arrival of the Fourth Industrial Revolution, a variety of issues arise. Perhaps one of the most important is to revisit entrepreneurship and start-ups. In other words, they should be redefined. Start-up business opportunities along with research on entrepreneurship should follow.

Business activities could be viewed as an integration between technological innovation and market efficiency. They allow products and services to be developed and distributed to end-consumers through the market. The main point is how new innovations based on new goods, new markets and new technologies can be successful in the market. Entrepreneurship contributes to the success of new business and innovative services. This is why innovative leadership that reinvigorates companies is referred to entrepreneurship (Lee, 2016).

Aileen Lee, a woman venture investor, originally referred a “unicorn” for a start-up whose corporate value exceeds a billion dollars. This is because although there are many start-ups, a huge success is a rarity. As the number of unicorns increased later, Bloomburg, the US media group, started to call a start-up whose corporate value is worth more than US $10bn a “decacorn”. The decacorn is an imaginary animal having ten horns. It means that they are rarer than unicorns.

In total, 174 companies were unicorns in 2016, according to Fortune, the US economy magazine; among them, 35 were Chinese companies. Uber, ranked as the first, showed capital assets worth US$62bn, followed by Xiaomi, ranked second, worth US$46bn. In 2015, there were 15 unicorn businesses in the Asia-Pacific area; among them, 10 were Chinese companies. Unicorns rapidly increase in numbers (Fortune, 2016): 221 companies have been identified as unicorns in 2017 (TechCrunch, 2017).

The representative new technology start-ups include Apple, Microsoft, Facebook and Amazon. The emergence of start-ups leading markets with innovative technologies appropriate with the arrival of the Fourth Industrial Revolution draws attention.

Innovative examples in manufacturing include an innovator in an electric automobile market Tessler and DJI in China. As for the ones with a grand platform, Instagram and WeChat are the instances using the “new” merge and acquisition (as known as M&A) strategy that acquires innovation. Consumer-related fields such as distribution and sharing or cooperation economy are examples for new start-ups. In distribution-related fields, unicorn companies include online market Etsy, and also Alibaba, a grand commercial platform in China. There are services such as Airbnb or Lyft, familiar to us, in the sharing economy. You can identify new start-ups in vertical markets such as other technology infrastructure, Fintech, health care and clean tech, as well as a rapidly growing Internet of Things (IoT) market.

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Phillippe Cases, the CEO of Spoke, said that unicorn enterprises, as start-ups growing at an alarming rate, “exists in general technology-related fields” (Frier and Newcomer, 2015). IoT companies include Nest (recently acquired by Google), DJI (specialized in drones) and Jasper, developing unmanned automobile technology. The emergence of start-ups is limitless.

Decacorn enterprises include Workday (specialized in personnel management application software), Dropbox (content management or sharing work tool), Palantir in e-ter (analytics or business intelligence) and Palo Alto Networks (security solution). In Fintech, there is a loan platform, Lufax. In IoT, there are DJI, SpaceX and Xiaomi, which sells household appliances. Also, there are Flipkart (online shopping service), WhatsApp (messenger service) and social media services such as Snapchat, Pinterest, Twitter, Facebook and LinkedIn. Finally, new decacorn start-ups such as Airbnb, Uber, DidiChuxing and Wework in the shared economy are growing.

Incumbents require dramatic innovation as company strategies at the emergence of the Fourth Industrial Revolution. Incremental innovation by internal competencies has been effective so far. It is in the era of disruptive innovation. Businesses cannot simply be disruptive internally. The integration of open innovation, open platform and internal venture is the only countermeasure for the disruptive innovation. In this regard, companies should attain entrepreneurship and business culture that are indispensable to convert efficiency into innovation, particularly disruptive innovation.

The remark by CISCO president John Chambers “Now all companies should think like start-ups” announces the advent of the disruptive innovation era.

Then what is “disruptive innovation culture” based on start-up spirit? It may be summarized into four words, open, share, cooperation and ecosystem. Why does Google reveal source codes of AlphaGo? Ninety-five per cent of Silicon Valley software is open source. Technology cooperation can be accomplished rapidly and cheaply when opened. We have to participate and practice a variety of open innovation movements under the principles of “open and share”.

The Fourth Industrial Revolution, where innovation and efficiency are cycling, means we are living in the era of start-ups. Case studies on innovative start-ups focusing on the direction of start-up research and entrepreneurship apt for this era are well-anticipated.

Finally, the APJIE Desk is happy to invite two more editorial board members, Professor Soo Hyun Jun of the Department of Tourism Management and Professor Seok Min Kang of the Department of Management at Keimyung University. The APJIE Desk is also proud to call for papers for the special issue on Korea Blockchain Standardization Forum and World Fintech Forum presenting “Blockchain on Business and Entrepreneurship (BoBE) 2017” for the APJIE Volume 11, No. 3, to be published in December 2017.

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Further reading
An exploratory study on the determinants of performance in regional industry technology development programs

Choo-Hui Park and Jin-Kyo Shin
Keimyung University, Daegu, South Korea

Abstract

Purpose – The purpose of this paper is to analyze the determinants of the performance of regional industrial technology development programs among the regional strategic industrial development program that the central government and Daegu metropolitan city jointly promoted between 2004 and 2012. Specifically, in this research, the authors are trying to identify the effects of R&D capabilities and technical development tasks on technological and managerial performance.

Design/methodology/approach – The dependent variables of this study are technical and economic performance. Technical performance, product and process innovation, economic performance, sales and export increases were measured using five-point Likert scales. The authors added the contribution of sales through technology development to economic performance. The independent variable is the company’s R&D capability, measured by the number of R&D staff compared to the average total number of employees from 2004 to 2012. The characteristics of the technology development tasks were measured by technical characteristics, market characteristics and collaborative research types. The technological characteristics were measured by seven factors, including technological change, technical difficulty, potential in commercialization, competition between domestic and foreign competitors, difficulty in introducing overseas technology and the technological gap. Market characteristics were largely divided into complexity, dynamics and competitiveness. The types of collaborative research were divided into whether or not there were collaborative research with the participation of large corporations. The control variables are firm size (number of employees) and firm age. Regression analysis was used to analyze the determinants of performance, and a difference analysis was conducted to determine the effect of collaborative research on performance.

Findings – The main determinants of the regional industrial technology development program performance are the characteristics of the technology development task rather than the internal R&D capability; moreover, the technical characteristics, complexity of the developed product market and participation of large corporations had significant effects on R&D capability. The R&D capacity of firms in internal R&D capacity had a significant effect only on the improvement of technology development ability. Therefore, R&D capacity, which is the main determinant of technology innovation, did not have a significant effect on the performance of short-term technology development tasks. Technological change, technological difficulty, competition between domestic and foreign competitors and the technological gap had positive effects on performance, excluding sales contributions. In addition, the complexity of the developed product market such as the diversification of demand, competitive product and sales distribution channels had positive influences on the performance of technology development programs, unlike dynamics and competitiveness. In this study, the authors cannot confirm the effect of collaborative research on the performance of the technology

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development programs, but they confirmed that collaborative research involving large corporations had a positive influence on performance.

**Research limitations/implications** – The results of the analysis of the determinants of regional industrial technology development programs suggest some implications in the future evaluation of these regional industrial technology development programs. It is necessary to review the application qualification and merit, advance review of the business plans and confirmation, an examination of the research results and performance of the applicants and a review of the technology and market situation of the project. For this, the authors suggest that the written review from the relevant technical experts be submitted to the evaluation committees. Also, when establishing regional industrial development programs, they should be evaluated thoroughly, including detailed information and contents about the technical and market characteristics of the local industry.

**Originality/value** – This research is one of the first to investigate the achievements of R&D support programs among regional industrial development programs in Korea. The results of this study can substantially contribute to the development and implementation of the R&D support policies of the central and local governments. Furthermore, the findings suggest guidelines for improving the performance of R&D support programs in the future. A theoretical model for enhancing the efficiency of government R&D support programs may be established, and an empirical analysis may be conducted to provide practical and academic implications for further research.

**Keywords** Regional industry technology development program, R&D capability, Technological characteristics, Complexity of the product market, Types of collaborative research

**Paper type** Research paper

1. **Introduction**

Since the late 1990s, the Korean government has actively promoted regional industrial policies centering on regional strategic industries. Through these efforts, it has developed a variety of strategies for building a regional industrial infrastructure, strengthening innovation capacity and promoting clusters of regional strategic industries by promoting projects in a packaged manner. At present, the regional industrial policy not only broadens the spatial scope, but also covers a wide range of industries such as city and provincial strategic industries, metropolitan economy-leading industries and municipal and district-specialized industries. However, after 2014, the metropolitan project was terminated and the (new) specialized project, which was a city-and-province center project, become a main program in 2015 (Figure 1).

Therefore, analyzing the performance of regional industry development policies that have been promoted since 1999 for the purpose of balancing national development and enhancing the competitiveness of regional industry will provide many implications for establishing a regional industry upbringing policy and for promoting business in the future. The purpose of this study is to investigate the determinants of regional industrial technology development programs among the regional strategic industry development programs that led to the active participation of local companies in regional R & D projects to expand the underdeveloped regional industrial base and to enhance industrial competitiveness.

The characteristics of the Daegu areas are as follows: In 2014, the economically active population of Daegu is 1,245,000, accounting for 4.9 per cent of the nationwide average. The annual growth rate since 2008 is 1.24 per cent, which is higher than the national average (1.16 per cent). As of 2014, Daegu has 192,000 businesses and employs 833,000 people, accounting for 4.5 per cent of the nation’s total. Daegu’s industrial structure is composed of agriculture, forestry and fisheries (0.4 per cent), mining and manufacturing (23.7 per cent) and service and others (75.9 per cent). Of these, the manufacturing industry is the main industry of machinery, automobile parts and textiles in 2014, and since 2000, the center of
manufacturing has been shifting to the machinery and metal industry. In the past 10 years, Daegu’s manufacturing structure has changed from 32.0 to 14.5 per cent of the textile industry, 30.1 to 43.1 per cent of machinery and metal industry, 14.4 to 16.8 per cent of auto parts and 5.4 to 7.0 per cent of rubber and plastic. There are 955 research and development organizations in Daegu area which it is accounting for 3.78 per cent of nationwide. And also, there are 20 (2.1 per cent) of public research institute R&D organizations, 15 (1.6 per cent) of university R&D organizations and 920 (96.3 per cent) corporate R&D organization. R&D innovation capacity such as researchers, R&D expenditure and patent registration numbers in Daegu has been steadily increasing, but relatively low compared to other cities.

This study consists of four parts. Part two introduces the purpose and contents of the regional industrial technology development programs, as well as the results of the program support, characteristics and achievements of the Daegu area. In part three, we present the analytical results of the variables and models for exploring the determinants of the performance of regional industrial technology development programs. Finally, part four discusses the policy implications and future research issues through a review of the research results.

2. Outline of regional industrial technology development program

2.1 Purpose of program, contents and achievement

Since 1999, the Korean government has promoted regional industry support programs, centering on regional strategic industries to support the upgrading of regional industries, support higher added-value, strengthen the competitiveness of companies and form a convergence cluster of strategic industries. The regional industrial support programs, based on the cluster concept, aim to develop independent regions by easing regional disparities and by directly fostering regional industries in doing so. Additionally, it has promoted
various projects in a packaged manner to enhance competencies and to promote the knowledge base of regional industries.

Focusing on the Daegu area, the government concentrated investment in textile, mechatronics, electronic information devices and biotechnology industries through local industrial support program since 1999. In the first phase (1999 ~ 2003), the government invested 100 per cent in the textile industry by the Milano project and in the second stage (2004 ~ 2008) with the aim of establishing a support system for new growth industry, they also invested on textile, mechatronics, including eight infrastructure construction programs, five enterprise support service programs, four human resource development programs and a planning operation program. In the third phase (2009 ~ 2012), aiming at the creation of a cluster of strategic industries expanding convergence cluster, the government support of a total of 20 programs including seven infrastructure construction programs, five enterprise support service programs, four technical support programs, three joint programs and planning operation program. In the second phase, Daegu Strategic Industries’ support by sector is in the order of textile (41 per cent), mobile (19 per cent), mechatronics (15 per cent), nanotechnology (13 per cent) and biology. Based on the type of business, technology development program (41 per cent), infrastructure construction program (35 per cent), technical support program (10 per cent) and regional innovation infrastructure construction program (7 per cent) were supported.

In particular, the regional industrial technology development programs led local companies to actively participate in regional R&D projects so as to expand the underdeveloped regional industrial base, strengthen industrial competitiveness and expand the technological innovation base. Specifically, they pursued customized R&D support in consideration of the characteristics of regional strategic industries, and they aimed to enhance regional competitiveness by fostering excellent companies that would lead the industry in terms of promoting regional strategic industries. To achieve this, they have focused on the development of commercialization (industrialization)-oriented technology rather than the development of original technology, by overcoming the formal linkages among the existing industry, education, academia and government.

There are four major strategic industries in the Daegu area, and in the regional industrial technology development programs, there were two reorganizations in the process of developing the regional strategic industries in the second and third phases. During the second phase, the basic technology development program was abolished from 2008, and the common technology development program and the key technology development program were converted into four programs (the local leading industry program, regional strategic planning program, regional linkage program and local-based technology development program). Since 2010, to simplify the program in accordance with the strategic industry conditions, the four programs were reorganized into two programs (task-design-type and free-open-type technology development programs) to support customized R&D, considering the characteristics of the regional strategic industries.

In the case of the Daegu region, the budget, supported by the regional industrial technology development programs in the second and third phases, was approximately 138,616 million won, which constituted an absolute proportion of the total regional industrial support programs, along with the regional industrial infrastructure construction industry. However, in the second phase, it decreased sharply by 62.1 per cent from 100,584 million won to the third phase, with 38,037 million won. This bottom-up type of free-open-type technology development program is more than the top-down type, including the designated type technology development program. In the case of the second phase, the bottom-up-type regional industrial technology development program and the regional
industrial basic technology development program accounted for an absolute proportion of 71,359 million won (70.9 per cent), while the third phase case amounted to 38,037 million won, and free competition technology development business amounted to 14,664 million won, accounting for 38.6 per cent (Figure 2).

2.2 Characteristics and performance of regional industrial technology development programs
Among the participants of regional industrial technology development programs, 59.4 per cent were corporations (incorporated), 23.2 per cent were research institutes (Technopark, Specialized Centers, etc.), 12.8 per cent were private companies and 4.0 per cent were universities and other institutions, such as associations, which accounted for 0.7 per cent. In the third phase, 91.7 per cent was in the form of a corporation (incorporated), while the second phase was only 52.7 per cent, and research institutes accounted for the highest percentage, with 28.3 per cent. In terms of shareholding by corporations (incorporated), the average holding ratio

![Figure 2. Local business support program reorganization progress](image-url)
of a manager was 83.9 per cent, while for employees, it was 7.4 per cent, foreigners accounted for 1.2 per cent and venture capital companies accounted for 7.4 per cent. In addition, the percentage of companies owning shares was 99.8 per cent, 31.8 per cent for employees, 21.1 per cent for venture capitalists and 5.5 per cent for foreigners.

The number of company employees, R&D staff and the importance of local industrial technology development programs are increasing at a fair rate, but there is a large variation among participating companies. The number of employees increased from '04 to '06 and decreased from '07 to '09 due to the global financial crisis. The level of technological innovation in the region has remained constant, regardless of the economic fluctuations due to the expansion of the base of technological innovation in the region through the regional industrial support programs and the active participation of regional companies (Table I).

According to the analysis, 40.3 per cent of the tasks set the final goal of the technology development program as a preparation stage for commercialization. For others, the most prevalent response was the preparation stage for practical applications, while research institutes, universities and other organizations aimed for basic and exploratory research stages. The main objective of the final goal was to develop new products (52.1 per cent), followed by the improvement of existing products, the development of new processes and the improvement of existing processes.

In the case of corporate tasks, the small- and medium-sized enterprises (SMEs; 44.3 per cent) and universities (42.3 per cent) were the most important research partners, whereas the technology development tasks, consisting of independent research and collaborative research with large corporations, accounted for 9.1 and 7.7 per cent, respectively. While collaborative research was the dominant form between SMEs and large corporations, most of the research conducted by other institutions (national research institutes, regional specialization centers, universities, etc.) was performed via project-based research. The major sources of ideas for technology development tasks were mostly from internal sources, followed by industry, conventions, exhibitions, research institutes and universities.

The technical characteristics of the technology development programs are characterized by the difficulty in developing technology and the high possibility of commercialization, while the intensity of domestic and foreign technology development competition was relatively low. Also, the third rather than the second phase showed a higher degree of technical difficulty and commercialization possibility (Figure 3).

<table>
<thead>
<tr>
<th>No. &amp; ratio of participants/year</th>
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<td><strong>Number of employees</strong></td>
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<td>Mean</td>
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<td>81.8</td>
<td>80.3</td>
<td>71.6</td>
<td>68.6</td>
<td>68.3</td>
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<td>Mean</td>
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<td><strong>Ratio of R&amp;D staff (%)</strong></td>
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<td>Mean</td>
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**Note:** The proportion of R&D personnel refers to the average proportion of R&D personnel by participating companies.
In terms of the complexity, dynamics and competitiveness, the environmental characteristics of the product market developed through the technology development programs were generally above the average level. Specifically, the diversity of customer demand, the complexity of production technology and the lack of professional technical staff were high (Table II).

It was found that 67.3 per cent of the respondents said that they achieved a technical goal of 100 per cent, which was the primary goal of the technology development program, and they achieved an average goal of 95.9 per cent per task. The achievement level of the target organizations was 97.3 per cent for research institutes, 95.4 per cent for companies, 94.0 per cent for universities and 112.0 per cent for other institutions (Table III).

### Table II. Environmental characteristics of the product market of local industrial technology development programs in Phases 2 and 3

<table>
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<tr>
<th>Complexity</th>
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<tr>
<td>1) Diversity of demand</td>
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<tr>
<td>2) Diversity of competitive products</td>
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<tr>
<td>3) Complexity of production technology</td>
<td>3.7</td>
</tr>
<tr>
<td>4) Variety of distribution and sales channels</td>
<td>3.3</td>
</tr>
<tr>
<td>5) Complexity of government policies and related laws</td>
<td>3.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dynamics</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>6) Frequency of new product development by competitors</td>
<td>3.4</td>
</tr>
<tr>
<td>7) Introduction of new technologies by competitors</td>
<td>3.4</td>
</tr>
<tr>
<td>8) Changes in material/technologies related to products</td>
<td>3.5</td>
</tr>
<tr>
<td>9) Changes in product use and demand patterns</td>
<td>3.5</td>
</tr>
<tr>
<td>10) The speed at which products become outdated</td>
<td>3.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Competitiveness</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>11) The degree of increase in the number of domestic and overseas competitors</td>
<td>3.3</td>
</tr>
<tr>
<td>12) The degree of price competition between competitors</td>
<td>3.5</td>
</tr>
<tr>
<td>13) Increasing production costs and decreasing profitability</td>
<td>3.4</td>
</tr>
<tr>
<td>14) Degree of lack of technical staff</td>
<td>3.6</td>
</tr>
<tr>
<td>15) Slowdown of market growth and demand decline</td>
<td>3.1</td>
</tr>
</tbody>
</table>

**Note:** A high score on a five-point scale means that the technology change is rapid, the technical difficulty is high, the competition is intense, introduction is difficult and the technology gap is large.
The reasons for not reaching the target goal of 100 per cent was the lack of a study period (23.5 per cent), followed by a lack of research funds (17.2 per cent), a lack of research and support facilities (16.3 per cent), high goal setting (15.8 per cent) and research environment changes (11.8 per cent).

Technical achievements such as intellectual property rights (patents, etc.), research papers and the technology transfer of local industrial technology development programs have continuously increased since the project was launched. Table IV shows the continuous effects of the program in terms of technological achievements, such as intellectual property rights, research papers and technology transfer due to technology development activities continuously from 2004 to 2009. The number of outcomes per 100 million won of cumulative project costs is also increasing. Therefore, it is evident that the budget invested in regional industrial technology development programs has had a substantial effect on research performance.

### Table III.
Achievement of the technical goal of the regional industrial technology development programs in Phases 2 and 3

<table>
<thead>
<tr>
<th>Organization/no. &amp; % of achievement goal</th>
<th>Less than 50%</th>
<th>50~80%</th>
<th>80~100%</th>
<th>Over 100%</th>
<th>No response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>682</td>
<td>31</td>
<td>185</td>
<td>459</td>
<td>2</td>
</tr>
<tr>
<td>Companies</td>
<td>492</td>
<td>27</td>
<td>132</td>
<td>326</td>
<td>2</td>
</tr>
<tr>
<td>Research institutes</td>
<td>158</td>
<td>1</td>
<td>41</td>
<td>116</td>
<td>2</td>
</tr>
<tr>
<td>Universities</td>
<td>27</td>
<td>3</td>
<td>12</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>5</td>
<td></td>
<td></td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

### Table IV.
Technical performance of the regional industrial technology development programs in Phases 2 and 3

<table>
<thead>
<tr>
<th>No. of achievement/year</th>
<th>'04</th>
<th>'05</th>
<th>'06</th>
<th>'07</th>
<th>'08</th>
<th>'09</th>
<th>'10</th>
<th>'11</th>
<th>'12</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intellectual property rights</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overseas</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patent</td>
<td>4</td>
<td>9</td>
<td>12</td>
<td>27</td>
<td>37</td>
<td>26</td>
<td>17</td>
<td>5</td>
<td>–</td>
<td>137</td>
</tr>
<tr>
<td>Registration</td>
<td>–</td>
<td>4</td>
<td>3</td>
<td>8</td>
<td>11</td>
<td>6</td>
<td>8</td>
<td>6</td>
<td>5</td>
<td>51</td>
</tr>
<tr>
<td>Domestic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patent</td>
<td>23</td>
<td>57</td>
<td>80</td>
<td>111</td>
<td>180</td>
<td>182</td>
<td>97</td>
<td>86</td>
<td>63</td>
<td>879</td>
</tr>
<tr>
<td>Registration</td>
<td>22</td>
<td>45</td>
<td>86</td>
<td>106</td>
<td>128</td>
<td>128</td>
<td>94</td>
<td>94</td>
<td>51</td>
<td>754</td>
</tr>
<tr>
<td>S/W register</td>
<td>4</td>
<td>4</td>
<td>6</td>
<td>5</td>
<td>15</td>
<td>10</td>
<td>2</td>
<td>1</td>
<td>–</td>
<td>47</td>
</tr>
<tr>
<td>Total</td>
<td>53</td>
<td>119</td>
<td>187</td>
<td>257</td>
<td>371</td>
<td>352</td>
<td>218</td>
<td>192</td>
<td>119</td>
<td>1,868</td>
</tr>
<tr>
<td>Research paper</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overseas</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCI</td>
<td>8</td>
<td>12</td>
<td>56</td>
<td>36</td>
<td>29</td>
<td>16</td>
<td>6</td>
<td>2</td>
<td>–</td>
<td>165</td>
</tr>
<tr>
<td>Peer-reviewed journal</td>
<td>–</td>
<td>2</td>
<td>6</td>
<td>9</td>
<td>12</td>
<td>8</td>
<td>3</td>
<td>3</td>
<td>–</td>
<td>43</td>
</tr>
<tr>
<td>Preceding papers</td>
<td>–</td>
<td>10</td>
<td>27</td>
<td>28</td>
<td>34</td>
<td>34</td>
<td>8</td>
<td>7</td>
<td>4</td>
<td>152</td>
</tr>
<tr>
<td>Domestic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCI</td>
<td>–</td>
<td>–</td>
<td>7</td>
<td>2</td>
<td>11</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>–</td>
<td>29</td>
</tr>
<tr>
<td>Peer-reviewed journal</td>
<td>13</td>
<td>9</td>
<td>21</td>
<td>40</td>
<td>41</td>
<td>40</td>
<td>23</td>
<td>17</td>
<td>5</td>
<td>209</td>
</tr>
<tr>
<td>Preceding papers</td>
<td>26</td>
<td>35</td>
<td>97</td>
<td>85</td>
<td>118</td>
<td>132</td>
<td>68</td>
<td>43</td>
<td>6</td>
<td>610</td>
</tr>
<tr>
<td>Total</td>
<td>47</td>
<td>68</td>
<td>214</td>
<td>200</td>
<td>245</td>
<td>232</td>
<td>110</td>
<td>77</td>
<td>15</td>
<td>1,208</td>
</tr>
<tr>
<td>Technology transfer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technology transfer</td>
<td>64</td>
<td>189</td>
<td>104</td>
<td>158</td>
<td>424</td>
<td>162</td>
<td>80</td>
<td>7</td>
<td>2</td>
<td>1,190</td>
</tr>
<tr>
<td>Technology transfer institutions</td>
<td>55</td>
<td>46</td>
<td>80</td>
<td>108</td>
<td>175</td>
<td>110</td>
<td>43</td>
<td>6</td>
<td>–</td>
<td>623</td>
</tr>
<tr>
<td>Venture</td>
<td>–</td>
<td>–</td>
<td>1</td>
<td>2</td>
<td>8</td>
<td>3</td>
<td>1</td>
<td>–</td>
<td>–</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>119</td>
<td>235</td>
<td>185</td>
<td>268</td>
<td>607</td>
<td>275</td>
<td>124</td>
<td>13</td>
<td>2</td>
<td>1,828</td>
</tr>
</tbody>
</table>
In addition to technological achievements, there is a technical ripple effect due to technological development programs such as the improvement of the technical development ability of the executing agency, the expansion of technical development investment, the spread of other products and other fields of development technology. First, 92.2 per cent responded that the technology development ability of the related field improved through the execution of the program, and 52.5 per cent responded that the investment in technology development expanded. Second, 87.6 per cent of the respondents said that the technology developed through the project had a significant impact on other products and fields. The utilization of the developed technology was provided for other research and upgrade studies (52.5 per cent), participation in conventions (41.2 per cent) and educational instructions (38.1 per cent). Third, it was found that the developed technology contributed greatly to the high added-value of the product. In addition, it contributed to the improvement of product quality, finding new ideas, solving product problems and training technical staff. Finally, there were many evaluations indicating that the local industry technology developing program was effective in the development of the regional strategic industry; furthermore, it influenced the revitalization of relevant industry, the cultivation of technical manpower and so on.

As the economic performance of the regional industrial technology development programs has been continuously expanding since 2004, project-related sales and exports have increased significantly. In addition, there have been economic results related to the profitability of companies such as new product creation, the import substitution effect, production cost reduction and the reduction of royalties. In addition, job creation and the research workforce were increased due to technology development programs.

As shown in Table V, the average sales related to tasks have steadily increased from 278.8 m won in 2004 to 1,229.2m won in 2012, and the average export amount has also increased steadily since 2004. As a result of the regional industrial technology development programs, the effects of import substitution, employment creation and the number of professional researchers have continuously grown from 2004 to 2012. The developed technology has contributed 33.1 per cent to the sales of products and has reduced the average time to entry into the related market by 2.9 years; moreover, the economic life of the developed technology has increased up to 8.6 years. Thus, these local industrial technology development programs have had a positive effect on the economic performance of enterprises.

The results of the regional industrial technology development programs can be summarized as follows: first, despite the weak industrial structure of the region, it was

<table>
<thead>
<tr>
<th>Performance/year</th>
<th>'04</th>
<th>'05</th>
<th>'06</th>
<th>'07</th>
<th>'08</th>
<th>'09</th>
<th>'10</th>
<th>'11</th>
<th>'12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total revenue</td>
<td>26,429</td>
<td>28,006</td>
<td>31,479</td>
<td>30,070</td>
<td>33,034</td>
<td>34,499</td>
<td>41,491</td>
<td>46,256</td>
<td>38,525</td>
</tr>
<tr>
<td>Revenue related to project</td>
<td>278.8</td>
<td>231.4</td>
<td>555.6</td>
<td>731.8</td>
<td>921.6</td>
<td>997.9</td>
<td>1,206.7</td>
<td>1,187.4</td>
<td>1,229.2</td>
</tr>
<tr>
<td>Export amount</td>
<td>83.3</td>
<td>174.2</td>
<td>225.9</td>
<td>392.4</td>
<td>526.5</td>
<td>848.8</td>
<td>945.1</td>
<td>951.4</td>
<td>787.3</td>
</tr>
<tr>
<td>Import substitution amount</td>
<td>1,275.0</td>
<td>617.4</td>
<td>769.4</td>
<td>593.6</td>
<td>511.2</td>
<td>719.8</td>
<td>774.2</td>
<td>661.2</td>
<td>640.0</td>
</tr>
<tr>
<td>Number of new products</td>
<td>21.7</td>
<td>2.5</td>
<td>2.7</td>
<td>3.6</td>
<td>4.3</td>
<td>5.1</td>
<td>6.1</td>
<td>5.5</td>
<td>2.6</td>
</tr>
<tr>
<td>Increase of employment</td>
<td>2.5</td>
<td>2.3</td>
<td>3.1</td>
<td>2.6</td>
<td>4.0</td>
<td>4.7</td>
<td>4.3</td>
<td>3.0</td>
<td>2.8</td>
</tr>
<tr>
<td>Professional Researchers</td>
<td>5.4</td>
<td>5.6</td>
<td>5.9</td>
<td>3.0</td>
<td>6.2</td>
<td>6.4</td>
<td>7.2</td>
<td>3.7</td>
<td>3.1</td>
</tr>
<tr>
<td>Loyalty savings</td>
<td>40.0</td>
<td>20.0</td>
<td>110.0</td>
<td>165.5</td>
<td>167.7</td>
<td>182.0</td>
<td>352.6</td>
<td>304.3</td>
<td>–</td>
</tr>
<tr>
<td>Production cost savings</td>
<td>115.0</td>
<td>71.4</td>
<td>122.6</td>
<td>179.1</td>
<td>196.0</td>
<td>271.5</td>
<td>273.1</td>
<td>70.2</td>
<td>40.9</td>
</tr>
</tbody>
</table>

Notes: Revenue and employment figures are an average, and '12 is expected; Unit: million won, person
found that the technological development program accomplished the desired achievement in the strategic industry field. It contributed to the high value-added business of the local strategic industry and the competitiveness of the market by carrying out support projects through selection and concentration, focusing on the specialization field of the strategic industry. It also created synergies through the revitalization of industry–university–government relations, based on our willingness to support industry continuously.

Second, to solve the difficulties of local enterprises, along with the technology development program, an integrated support system was built by securing facilities and professional manpower from product material development to commercialization. In detail, a support network for strategic industries was established and revitalized, centering on Technopark and Specialized Centers. The corporate support system was also strengthened through the establishment of expert pools for solving difficulties of the local enterprises, agreements between innovative resources, such as the joint use of equipment, and revitalized community management and participation by each strategic industry.

Third, despite the high-cost efficiency and commercialization success rate of the regional industrial technology development programs, issues were raised based on the constant duplication problem (borrowing the central unit program without planning) and a lack of strategy. This was due to the lack of differentiation from the central unit projects, the stage of technology development, the period of support, the support target and the development of excellent companies that would lead the industry in terms of fostering regional strategic industries. This was due to a lack of support for innovation-led policies, such as customized support policies.

3. Exploratory analysis
3.1 Variables and models
The importance of technological innovation in the new enterprise can be judged by how much the interest of the researchers is increasing. Technology innovation has become a key factor in sustainable competitive advantage, and it is also the most important challenge for SMEs (O’Regan et al., 2006). As the perception that technological innovation is a driving force for improving corporate competitiveness is increasing, many studies suggest various technological innovation determinants. Among these, R&D capability and technical characteristics have been mentioned as very important influencing factors. In the previous studies, Becheikh et al. (2006) systematically summarized 108 empirical studies related to technological innovation from 1993 to 2003 and have found that the research and development capacity, networking and market factors of a company are very important for technological innovation and management performance. Van der Panne et al. (2003) also examined the factors affecting the success and failure of technological innovation based on 43 studies related to technological innovation projects from 1972 to 1999, and as a result that R&D capability, market and technology factors positively impact on technological innovation.

R&D capability is a core competency for shortening the development period of new products, and is an essential factor for enhancing new product development performance (Dutta et al., 1999). Souitaris (2002) also argues that corporate R&D activities are an important source of innovation, and that R&D capabilities have a positive impact on a firm’s innovation performance. Huiban and Boushina (1998) showed that R&D capacity is very important in radical innovation with technological experts, which is a key determinant of technological innovation (Freel, 2003; Romijn and Albaladejo, 2002).
Hall and Bagchi-Sen (2002) also showed a positive relationship between R&D capacity and technological innovation performance, and Hadjimanolis (2000) found a positive relationship between the R&D capacity of SMEs and technically innovative performance, respectively. Freel (2003), moreover, found that R&D capabilities have a positive impact on the likelihood of introducing new products. In addition, the many previous empirical studies suggested that the R&D capability has a positive effect on technological innovation and management performance (Kirkley, 2016; Lee et al., 2014; Shin et al., 2009; Hwang and Shin, 2015; Keizer et al., 2002; Landry et al., 2002; Thamhain, 2003).

Technical characteristics are an opportunity to supply the technical ideas necessary for technology development. In some cases, technical characteristics are recognized through various organizations, institutions and environments. In the case of high technological change, technological difficulty, competition between domestic and foreign competitors and the technological gap, technological innovation will produce active technological innovations, but if not, then the technological innovation will be limited (Song, 2000). In addition, the industry determines the technical characteristics, and with high technical characteristics, a higher frequency of new products is introduced. Furthermore, there are differences in the frequency of innovative new product development (Kotabe and Swan, 1995) and the rate of technology commercialization (Schoomhoven et al., 1990), which depend on the industry. All organizations cannot escape the influence of the environment, and management decisions are diversified as the environment changes.

Michie and Sheehan (2003) demonstrate that intra-firm competition and market growth have positive effects on technological innovation. In other words, they found that as competition intensifies among industries, technology demand increases as market demand increases. In addition, Smolny (2003) argued that technological innovation is faster, as the competition between technology development firms is competitive or the technical difficulty is high. Zahra (1993) also demonstrated that the faster the rate of change of technology, the faster the innovation appears. Souitaris (2001) shows that the more demand and competition, products are diversified. And the more technological innovation created when the sales channels complex and increases of technology development competition among competitors are strong. In addition, Yoon and Lilien (1985), Kim and Choi (2016) pointed out that as competition intensifies among competitors in the market, competition for technology development among competitors becomes more intense.

The external environment is the primary source of uncertainty for managers who need to identify opportunities and threats (Duncan, 1972), and the dynamics of the environment are highly correlated with changes in corporate behavior. In particular, since the environment is changing rapidly nowadays, SMEs are forced to rely more on environmental characteristics. In previous studies, uncertainty in the environment increased innovation (Song and Kim, 2005; Chandy et al., 2003). Because technological innovation is generally an expensive process that cannot recover costs, companies in a stable environment feel less need to pay for such innovation costs (Miller, 1988). In other words, companies in a dynamic environment are constantly innovating to outpace their competitors and to meet the needs of changing customers. An uncertain environment will have a positive impact on technological innovation activities that change the product or technology as a result of affecting the firm's strategy formulation. In the study of Miller and Friesen (1982), high environmental dynamics improved innovation performance, and Kim and Park (2009) also showed that environmental uncertainty has a positive effect on technological innovation capacity. In a study by Lee and Kim (2012) on Chinese SMEs,
the higher the domestic and foreign market environment factors, the more positive the financial performance was.

Cooperative activities for technology development and collaborative research can have a positive impact on tasks and firm performance. Kaufmann and Todtling (2001) show that there is a difference in technological innovation depending on the type of collaborative research with Universities and research institute. In addition, Landry et al. (2002) reported that R&D by interaction with suppliers and customers has a positive effect on technological innovation. Nieto and Quevedo (2005) also reported that formal and informal acquisitions of technology and knowledge have positive effects on technological innovation. Bae and Jung (1997) suggest that the size and utilization of technology cooperation have a positive effect on firm performance. In particular, technical performance is influenced by the size and diversity of formal technical cooperation, and commercial performance is influenced by the size of formal technical cooperation. Oh (2006) analyzed the effects of tasks, and R&D subject and procedural characteristics on technological and commercial goal achievement, and performance satisfaction, focusing on government-funded core technology development projects. As a result, the higher the strategic importance of the project and the higher the possibility of commercialization, the higher the possibility of success of the joint research. Also, when companies pursue industry–university cooperation, they consider the partner’s joint research experience and the degree of research and development ability much more, as compared to the case of industry–industry cooperation. Specifically, when the host organization is a large corporation, it is more prominent than the case of SMEs. In the analysis by the hosting institution, when the large corporation is the main institution, it is found that the overall achievement of the collaborative research is higher in achieving the early goal than the small business, relatively speaking. In addition, there are many studies that show that network-based collaborative research and acquisition of formal/informal knowledge have a positive effect on technological innovation (Barba-Sanchez and Atienza-Sahuquillo, 2011; Love and Roper, 2001; Landry et al., 2002, Papadakis and Bourantas, 1998; Ritter and Gemunden, 2003; Sung, 2006).

In this study, we analyzed 492 projects, except for the projects that were not supported by the main organizer and the projects that were not supported by the regional industrial technology development programs from January 1, 2004 to December 31, 2012, respectively. The purpose was to analyze the determinants of the performance of the regional industrial technology development programs in terms of the above-mentioned variables (Table VI).

Performance variables were classified into technical and economic performance. Technical performance is measured as the technological productivity product innovation and production innovation with five-point Likert scales. Economic performance is measured as the sales and export increase. In addition, the contribution of sales through technology development to economic performance was added. Given that this is a performance analysis of the technology development program rather than an enterprise performance analysis, the factors determining the business performance are divided into internal R&D capability and characteristics of the technology development program. The internal R&D capability of companies was measured by whether or not they registered the R&D institutes and the proportion of the R&D staff. The characteristics of the technology development program were measured by the technical characteristics, market characteristics and collaborative research types. The technological characteristics were measured by seven factors, including technological change, technical difficulty, potential in commercialization, competition between domestic and foreign competitors, difficulty in introducing overseas technology
and the technological gap using five-point Likert scales. The market characteristics were largely divided into complexity, dynamics and competitiveness. The types of collaborative research were divided into whether or not they were collaborative research. The control variables were firm size (number of employees) and firm age (Figure 4).

<table>
<thead>
<tr>
<th>Variables</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project achievement</td>
<td></td>
</tr>
</tbody>
</table>
| Technical performance                    | Improvement of technology development ability in related fields
|                                          | Product innovation: Average of contribution on quality improvement, product high value-added, product troubleshooting
|                                          | Production innovation: Average of contribution on increasing productivity, contributing to production, problem solving at workplace |
| Economic performance                     | Increase in sales and exports: average of contribution of sales increase and export increase
|                                          | New technology revenue contribution: the percentage of developed technology contributed to sales of the product |
| R&D capability                           | Number of registered R&D institutes
|                                          | The ratio of R&D staff to the total number of employees in 2004–2012 |
| The characteristics of the technology development program |                                                                             |
| Technical characteristics                | Technology changes fast
|                                          | Technical difficulty is high
|                                          | Very high potential in commercialization
|                                          | Strong competition for technological development in the domestic market
|                                          | Worldwide strong competition for technological development
|                                          | Difficult to introduce overseas technology
|                                          | Large technology gap with developed countries |
| Market characteristics                   |                                                                             |
| Complexity                               | Diversity of consumers’ demand
|                                          | Diversity of competing products
|                                          | Complexity of production technology
|                                          | Variety of distribution and sales channels
|                                          | Complexity of government policies and related laws |
| Dynamics                                 | Frequency of new product development by competitors
|                                          | Introduction of new technologies by competitors
|                                          | Changes in material/technology related to products
|                                          | Changes in product use and demand patterns
|                                          | The speed of when products become obsolete
|                                          | Increase of domestic and overseas competitors
|                                          | Price competition among competitors
|                                          | Increasing production costs and falling profitability
|                                          | Lack of experts
|                                          | Slow in market growth and demand declines |
| Competitiveness                          |                                                                             |
|                                          | Dummy variable indicating joint research
|                                          | Dummy variable indicating large companies participate in joint research |
| Types of collaborative research          |                                                                             |
| Control variables                        |                                                                             |
| Firm’s age                               | Years since establishment |
| Size                                     | Average number of employees from 2004 to 2012 |

Table VI. Definition of variables and measurement
3.2 Results of the analysis

Table VII presents the results of analyzing the effects of R&D capability and technical development program characteristics on technical and economic performance of the regional industrial technology development programs, while controlling for the size and age of the firms. For the R&D capabilities, the presence of a company-affiliated research institute had no effect on technological or economic performance. The proportion of R&D staff had a positive effect on the improvement of technology development capability with regard to technological performance, but it had a negative effect on sales and exports with respect to economic performance. In terms of the technological development program, technical characteristics had a positive influence on the improvement of technology development capability, product innovation and process innovation. For economic performance, both sales and exports had a positive influence on it. For market characteristics, complexity positively influenced the technological achievement improvement of technology development, product innovation, sales of economic performance and increase of exports. Dynamics had a significant negative impact on sales and exports, while competitiveness had a positive impact on process innovation and a negative impact on sales contribution with respect to economic performance. Finally, the relationship between technological and economic performance and the type of collaborative research (characteristics of joint research, participation of large corporations) in the technological development program showed that collaborative research had no effect on the dependent variables. However, the participation of large corporations had a positive effect on the contribution of sales in terms of technology achievement improvement, process innovation and economic performance. Firm size had a significantly negative impact on sales and export growth in regard to product innovation, process innovation and economic performance, such as sales and an
increase of exports. On the other hand, firm age had a significant negative impact on sales contribution only in regard to economic performance.

Table VII shows that the main determinants of regional industrial technology development performance are characteristics of the technology development program rather than internal R&D capabilities. Among them, the technical characteristics, complexity of the developed product market and the participation of large corporations had a positive effect. The proportion of R&D staff among firms’ internal R&D capacity had a significant influence on the achievement of improved technology development capability. R&D capability, which is a major determinant of technological innovation, had no significant effect on the performance of short-term technology development projects. Technological change, technological difficulty, competition between domestic and foreign competitors and the technological gap had positive effects on performance, excluding sales contributions. In addition, the complexity of the developed product market, such as the diversification of demand, competitive products and sales distributions, had a positive effect on the performance of technology development programs, unlike dynamics and competitive performance. This study could not confirm the effect of collaborative research on the performance of the technology development program, but concluded that collaborative research involving large corporations had a positive effect on the performance. In addition, additional analyses were conducted, and the results are presented in Table VIII. The type of collaborative research was classified into eight categories; there was a meaningful difference between the types of improvement in technology development capability and product
innovation at the levels of 1 and 10 per cent, significantly. Particularly, the technology development programs in which large corporations participated showed high performance in all sectors with regard to performance.

4. Discussion
4.1 Summary of results
This study analyzed the determinants of performance for 492 industrial technology development programs in the Daegu area at Phases 2 and 3. The main results are summarized as follows. First, the presence of R&D capability in company-affiliated research institutes had no effect on technological or economic performance, which is a dependent variable. On the other hand, the proportion of R&D staff in R&D capability was positively influenced only in improving the technology development capability of technical achievement.

Second, the technical characteristics of the technology development program had a positive effect on technical performance (technology development ability improvement, product innovation, process innovation) and economic performance (sales and export increases), excluding the contribution of sales. Third, the complexity, which is the market characteristic of the technology development program, positively influenced the increase in technology development ability, product innovation, economic performance and the increase in exports. The market characteristics of dynamics had no significant effect on the

<table>
<thead>
<tr>
<th>Research type/performance</th>
<th>Technical performance</th>
<th>Economic performance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Improve technology</td>
<td>Product innovation</td>
</tr>
<tr>
<td>Single research</td>
<td>4.04</td>
<td>3.81</td>
</tr>
<tr>
<td>Collaborative research</td>
<td>4.15</td>
<td>3.82</td>
</tr>
<tr>
<td>Industry-industry</td>
<td>4.06</td>
<td>3.70</td>
</tr>
<tr>
<td>Participation</td>
<td>4.50</td>
<td>4.34</td>
</tr>
<tr>
<td>No participation</td>
<td>3.61</td>
<td>3.61</td>
</tr>
<tr>
<td>Industry-research institute</td>
<td>4.29</td>
<td>3.95</td>
</tr>
<tr>
<td>Industry-university</td>
<td>4.04</td>
<td>3.66</td>
</tr>
<tr>
<td>Industry-industry-research institute</td>
<td>4.14</td>
<td>3.79</td>
</tr>
<tr>
<td>Participation</td>
<td>4.25</td>
<td>3.58</td>
</tr>
<tr>
<td>No participation</td>
<td>4.13</td>
<td>3.81</td>
</tr>
<tr>
<td>Industry-industry-university</td>
<td>4.09</td>
<td>3.80</td>
</tr>
<tr>
<td>Participation</td>
<td>4.50</td>
<td>3.83</td>
</tr>
<tr>
<td>No participation</td>
<td>4.00</td>
<td>3.80</td>
</tr>
<tr>
<td>Industry-university-research institute</td>
<td>3.94</td>
<td>3.74</td>
</tr>
<tr>
<td>Participation</td>
<td>4.19</td>
<td>3.86</td>
</tr>
<tr>
<td>No participation</td>
<td>4.10</td>
<td>3.89</td>
</tr>
</tbody>
</table>

Table VIII. Analysis of performance difference according to the type of collaborative research and participation of large corporations

<table>
<thead>
<tr>
<th>Types of collaborative research</th>
<th>p &lt; 0.003</th>
<th>p &lt; 0.063</th>
<th>p &lt; 0.255</th>
<th>p &lt; 0.531</th>
<th>p &lt; 0.115</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participation of large corporations</td>
<td>p &lt; 0.000</td>
<td>p &lt; 0.087</td>
<td>p &lt; 0.005</td>
<td>p &lt; 0.276</td>
<td>p &lt; 0.038</td>
</tr>
<tr>
<td>Interaction effects</td>
<td>p &lt; 0.641</td>
<td>p &lt; 0.094</td>
<td>p &lt; 0.172</td>
<td>p &lt; 0.250</td>
<td>p &lt; 0.367</td>
</tr>
</tbody>
</table>
dependent variables. Competitiveness, which is a market characteristic, had a positive effect on the process innovation of technological performance. Therefore, the complexity of the developed product market, such as the diversity of demand, competitive product and sales distribution, had a positive effect on the performance of the technology development program, unlike the dynamics and competitive performance. Fourth, although the joint research type of collaborative research, which is a part of the technology development program, did not have any influence on the dependent variable, participation in large corporations was positively related to technological performance, such as improvement in the technology development capability, process innovation and economic performance. It had a significant effect.

4.2 Policy implications and future research agendas
The results of analyzing the determinants of the regional industrial technology development programs in the second and third phases suggest some implications in the future evaluation of regional industrial technology development programs. It is necessary to review the application qualification and merit, advance review of the business plans and confirmation, an examination of the research results and performance of the applicants, and a review of the technology and market situation of the project. For this, we suggest that the written review from the relevant technical experts be submitted to the evaluation committees. Also, when establishing the regional industrial development plan, the program should be evaluated thoroughly, including detailed information and contents of the technical and market characteristics of the local industry. To improve the current evaluation system, which is much more focused on the performance of the technological development goal, it is necessary to evaluate between the market characteristics of new product lines and the feasibility of the program. Additionally, it is important to have specialized evaluators who can evaluate the programs in all aspects at the same time. Moreover, consideration should be given to collaborative research with large corporate projects to complement R&D capability, commercialization for developed products and an expanded demand. The type of collaborative research that was introduced as an independent variable in this study was not as significant as other independent variables. However, there was some difference in the analysis of collaborative research and participation in large corporations. Therefore, rather than introducing the type of collaborative research as an independent variable, it can be used as a moderating variable for the relationship between R&D capability and its performance, technical and market characteristics and business performance. In the case of adopting it as a moderating variable, it is necessary to subdivide the type of collaborative research; industry to industry, industry to research institute, industry to university, and whether to participate in large corporations. In the future, it is necessary to consider the characteristics of the industry, the characteristics of the participants, the level of the company’s technology and the stage of industrial growth.

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**Corresponding author**
Choo-Hui Park can be contacted at: juliapark@kmu.ac.kr

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Case study on adoption of new technology for innovation
Perspective of institutional and corporate entrepreneurship

Junghhee Han
Graduate School of Smart City Science Management, Hongik University, Sejong, South Korea, and

Chang-min Park
Graduate School of Business, Chonnam National University, Gwangju, South Korea

Abstract
Purpose – This paper aims at investigating the role of institutional entrepreneurship and corporate entrepreneurship to cope with firm’s impasses by adoption of the new technology ahead of other firms. Also, this paper elucidates the importance of own specific institutional and corporate entrepreneurship created from firm’s norm.

Design/methodology/approach – The utilized research frame is as follows: first, perspective of studies on institutional and corporate entrepreneurship are performed using prior literature and preliminary references; second, analytical research frame was proposed; finally, phase-based cases are conducted so as to identify research objective.

Findings – Kumho Tire was the first tire manufacturer in the world to exploit the utilization of radio-frequency identification for passenger car’s tire. Kumho Tire takes great satisfaction in lots of failures to develop the cutting edge technology using advanced information and communication technology cultivated by heterogeneous institution and corporate entrepreneurship.

Originality/value – The firm concentrated its resources into building the organization’s communication process and enhancing the quality of its human resources from the early stages of their birth so as to create distinguishable corporate entrepreneurship.

Keywords RFID, Corporate entrepreneurship, Institutional entrepreneurship

Paper type Research paper

1. Introduction
Without the entrepreneur, invention and new knowledge possibly have lain dormant in the memory of persons or in the pages of literature. There is a Korean saying, “Even if the beads are too much, they become treasure after sewn”. This implies importance of...
entrepreneurship. In general, innovativeness and risk-taking are associated with entrepreneurial activity and, more importantly, are considered to be important attributes that impact the implementation of new knowledge pursuing.

Implementation of cutting edge technology ahead of other firms is an important mechanism for firms to achieve competitive advantage (Capon et al., 1990; D’Aveni, 1994). Certainly, new product innovation continues to play a vital role in competitive business environment and is considered to be a key driver of firm performance, especially as a significant form of corporate entrepreneurship (Srivastava and Lee, 2005). Corporate entrepreneurship is critical success factor for a firm’s survival, profitability and growth (Phan et al., 2009).

The first-mover has identified innovativeness and risk-taking as important attributes of first movers. Lumpkin and Dess (1996) argued that proactiveness is a key entrepreneurial characteristic related to new technology adoption and product. This study aims to investigate the importance of corporate and institutional entrepreneurship through analyzing the K Tire’s first adaptation of Radio-frequency identification (RFID) among the world tire manufactures. Also, this paper can contribute to start ups’ readiness for cultivating of corporate and institutional entrepreneurship from initial stage to grow and survive.

K Tire is the Korean company that, for the first time in the world, applied RFID to manufacturing passenger vehicle tires in 2013. Through such efforts, the company has built an innovation model that utilizes ICTs. The adoption of the technology distinguishes K Tire from other competitors, which usually rely on bar codes. None of the global tire manufacturers have applied the RFID technology to passenger vehicle tires. K Tire’s decision to apply RFID to passenger vehicle tires for the first time in the global tire industry, despite the uncertainties associated with the adoption of innovative technologies, is being lauded as a successful case of innovation. In the global tire market, K Tire belongs to the second tier, rather than the leader group consisting of manufacturers with large market shares. Then, what led K Tire to apply RFID technology to the innovation of its manufacturing process? A company that adopts innovative technologies ahead of others, even if the company is a latecomer, demonstrates its distinguishing characteristics in terms of innovation. As such, this study was motivated by the following questions. With regard to the factors that facilitate innovation, first, what kind of the corporate and institutional situations that make a company more pursue innovation? Second, what are the technological situations? Third, how do the environmental situations affect innovation? A case study offers the benefit of a closer insight into the entrepreneurship frame of a specific company. This study has its frame work rooted in corporate entrepreneurship (Guth and Ginsberg, 1990; Shane and Venkataraman, 2000) and institutional entrepreneurship (Battilana, 2006; Fligstein, 1997; Rojas, 2010). As mentioned, we utilized qualitative research method (Yin, 2008). This paper is structured as follows. Section two presents the literature review, and section three present the methodology and a research case. Four and five presents discussion and conclusions and implications, respectively.

2. Theoretical review and analysis model
RFID technology is to be considered as not high technology; however, it is an entirely cutting edged skills when combined with automotive tire manufacturing. To examine why and how the firm behaves like the first movers, taking incomparable high risks to achieve aims unlike others, we review three kinds of prior literature. As firms move from stage to stage, they have to revamp innovative capabilities to survive and ceaseless stimulate growth.
2.1 Nature of corporate entrepreneurship

Before reviewing the corporate entrepreneurship, it is needed to understand what entrepreneurship is. To more understand the role that entrepreneurship plays in modern economy, one need refer to insights given by Schumpeter (1942) or Kirzner (1997). Schumpeter suggests that entrepreneurship is an engine of economic growth by utilization of new technologies. He also insists potential for serving to discipline firms in their struggle to survive gale of creative destruction. While Schumpeter argued principle of entrepreneurship, Kirzner explains the importance of opportunities. The disruptions generated by creative destruction are exploited by individuals who are alert enough to exploit the opportunities that arise (Kirzner, 1997; Shane and Venkataraman, 2000).

Commonly all these perspectives on entrepreneurship is an appreciation that the emergence of novelty is not an easy or predictable process. Based on literature review, we note that entrepreneurship is heterogeneous interests and seek “something new” associated with novel outcomes. Considering the literature review, we can observe that entrepreneurship is the belief in individual autonomy and discretion, and a mindset that locates agency in individuals for creating new activities (Meyer et al., 1994; Jepperson and Meyer, 2001).

As a multi-dimensional phenomenon that depends more on the successful interaction among a number of activities than single factor, corporate entrepreneurship (CE) is important for a company’s survival, profitability and growth. CE refers to the process of firm’s renewal relates to phenomena (Guth and Ginsberg, 1990). Jennings and Lumpkin (1989) defined corporate entrepreneurship as the act of new products or new knowledge. Similarly numerous other scholars emphasized new product innovation as an important activity in corporate entrepreneurship (Covin and Miles, 1999; Shane and Venkataraman, 2000; Kuratko, 2007; Phan et al., 2009). According to the Zahra’s (1991) definition, corporate entrepreneurship is a formal or informal activity aimed at creating values, in established firms through product and process innovations by using new technology. In the 1996, Zahra (1996) identified three factors of corporate entrepreneurship:

1. the firm’s commitment to innovation (including creation and introduction of products, emphasis on R&D investments and commitment to patenting);
2. the firm’s venturing activities, such as entry into new business fields by sponsoring new ventures and creating new businesses; and
3. strategic renewal efforts aimed at revitalizing the firm’s ability to compete.

These activities may take place at the firm, division, functional or project levels, with the unifying objective of improving the firm’s competitive position and financial performance. Firms can strive to create and nurture new values that have never existed before by utilization of corporate entrepreneurship – corporate entrepreneurship. Considering the prior literature, we summarized the corporate entrepreneurship as an important success factor:

- developing innovation an organizational tool;
- allowing the employees to propose ideas; and
- encouraging and nurturing the new knowledge (Hisrich, 1986; Kuratko, 2007).

Consistent with the above stream of research, our paper focuses on a firm’s new adaptation of RFID as a significant form of corporate entrepreneurial activity. Thus, CE refers to the activities a firm undertakes to stimulate innovation and encourage calculated risk taking throughout its operations. Considering prior literature reviews, we propose that corporate entrepreneurship...
entrepreneurship is the process by which individuals inside the organization pursuing opportunities without regards to the resources they control.

If a firm has corporate entrepreneurship, innovation (i.e. transformation of the existing firm, the birth of new business organization and innovation) happens. In sum, corporate entrepreneurship plays a role to pursue to be a first mover from a latecomer by encompassing the three phenomena.

2.2 Institution and institutional entrepreneurship

Most literature regarding entrepreneurship deals with the attribute of individual behavior. More recently, scholars have attended to the wider ecosystem that serves to reinforce risk-taking behavior. Institution and institutional entrepreneurship is one way to look at ecosystem that how individuals and groups attempt to try to become entrepreneurial activities and innovation.

Each organization has original norm and intangible rules. According to the suggestion by Scott (1995), institutions constrain behavior as a result of processes associated with institutional pillars. The question how actors within the organizations become motivated and enabled to transform the taken-for-granted structures has attracted substantial attention for institutionalist. To understand why some firms are more likely to seek innovation activities despite numerous difficulties and obstacles, we should take look at the institutional entrepreneurship.

The definition of institutions is variety. Concerning the definition of that, Hoffman’s definition is commonly quoted. Hoffman (1999) argues that institution is defined as “rules, norms, and beliefs that describe reality for the organization, explaining what is and is not, what can be acted upon and what cannot”. Each organization exists in a specific-environment of institutions that exert some degree of pressure on them. In other words, institutional environments contained by the elaboration of their rules to which workers must conform if they are to receive support and legitimacy (Scott, 1995). Scott (1995) argues that institutions influence behavior as a result of process associated with three institutional pillars:

1. the regulative, which induces worker’s action through coercion and formal sanction;
2. the normative, which induces worker’s action through norms of acceptability and ethics; and
3. the cognitive, which induces worker’s action through categories and frames by which actors know and interpret their world.

North (1990) defines institutions as the humanly devised constraints that structure human action. Actors within some organization with sufficient resources have intend to look at them an opportunity to realize interests that they value highly (DiMaggio, 1988).

It opened institutional arguments to ideas from the co-evolving entrepreneurship literature (Aldrich and Fiol, 1994; Aldrich and Martinez, 2001). The core argument of the institutional entrepreneurship is mechanisms enabling force to motivate for actors to act difficult task based on norm, culture and shared value. The innovation, adopting RFID, a technology not verified in terms of its effectiveness for tires, can be influenced by the institution of the society.

A firm is the organizations. An organization is situated within an institution that has social and economic norms. Opportunity is important for entrepreneurship. The concept of institutional entrepreneurship refer to the activities of worker or actor who have new
opportunity to realize interest that they values highly (DiMaggio, 1988). DiMaggio (1988) argues that opportunity for institutional entrepreneurship will be “seen” and “exploited” by within workers and not others depending on their resources and interests respectively.

Despite that ambiguity for success was given, opportunity and motivation for entrepreneurs to act strategically, shape emerging institutional arrangements or standards to their interests (Fligstein and Mara-Drita, 1996; Garud et al., 2002; Hargadon and Douglas, 2001; Maguire et al., 2004).

Resource related to opportunity within institutional entrepreneurship include formal or informal authority and power (Battilana, 2006; Rojas, 2010). Maguire et al. (2004) suggest legitimacy as an important ingredient related to opportunity for institutional entrepreneurship. Some scholars suggest opportunity resources for institutional entrepreneurship as various aspects. For instance, Marquie and Hardy (2009) show that knowledge and expertise is more crucial resources. Social capital, including market leadership and social network, is importance resource related to opportunity (Garud et al., 2002; Lawrence et al., 2005; Townley, 2002). From a sociological perspective, change associated with entrepreneurship implies deviations from some norm (Garud and Karnøe, 2003).

Institutional entrepreneurship is therefore a concept that reintroduces agency, interests and power into institutional analyses of organizations. Based on the previous discussion, this study defines institution as three processes of network activity; coercion and formal sanction, normative and cognitive, to acquire the external knowledge from adopting common goals and rules inside an organization. It would be an interesting approach to look into a specific company to see whether it is proactive towards adopting ICTs (e.g. RFID) and innovation on the basis of such theoretical background.

2.3. Theoretical analysis frame
Companies innovate themselves in response to the challenges of the ever-changing markets and technologies, so as to ensure their survival and growth (Tushman and Anderson, 1986; Tidd and Bessant, 2009; Teece, 2014). As illustrated above, to achieve the purpose of this study, the researcher provides the following frames of analyses based on the theoretical background discussed above (Figure 1).

![Figure 1. Integrated frame of analysis](image-url)
3. Case study
3.1 Methodology
It is a highly complicated and tough task to analyze the long process of innovation at a company. In this paper, we used analytical approach rather than the problem-oriented method because the case is examined to find and understand what has happened and why. It is not necessary to identify problems or suggest solutions. Namely, this paper analyzes that “why K Tire becomes a first mover from a late comer through first adoption of RFID technology for automotive tire manufacture with regards to process and production innovations”.

To study the organizational characteristics such as corporate entrepreneurship, institutional entrepreneurship, innovation process of companies, the qualitative case study is the suitable method. This is because a case study is a useful method when verifying or expanding well-known theories or challenging a specific theory (Yin, 2008). This study seeks to state the frame of analysis established, based on previously established theories through a single case. K Tire was selected as the sample because it is the first global tire manufacturer, first mover to achieve innovation by developing and applying RFID.

The data for the case study were collected as follows. First, this study was conducted from April 2015 to the end of December 2015. Additional expanded data also were collected from September 12 to November 22, 2016, to pursue the goal of this paper. Coauthor worked for K Tire for more than 30 year, and currently serves as the CEO of an affiliate company. As such, we had the most hands-on knowledge and directed data in the process of adoption RFID. This makes this case study a form of participant observation (Yin, 2008). To secure data on institutional entrepreneurship, in-depth interviews were conducted with the vice president of K Tire. The required data were secured using e-mail, and the researchers accepted the interviewees’ demand to keep certain sensitive matters confidential. The interviewees agreed to record the interview sessions. In this way, a 20-min interview data were secured for each interviewee. In addition, apart from the internal data of the subject company, other objective data were obtained by investigating various literatures published through the press.

3.2 Company overview
In September 1960, K Tire was established in South Korea as the name of Samyang Tire. In that time, the domestic automobile industry in Korea was at a primitive stage, as were automotive parts industries like the tire industry. K Tire products 20 tires a day, depending on manual labor because of our backward technology and shortage of facilities.

The growth of K Tire was astonishment. Despite the 1974 oil shock and difficulties in procuring raw materials, K Tire managed to achieve remarkable growth. In 1976, K Tire became the leader in the tire sector and was listed on the Korea Stock Exchange. Songjung plant II was added in 1977. Receiving the grand prize of the Korea Quality Control Award in 1979, K Tire sharpened its corporate image with the public. The turmoil of political instability and feverish democratization in the 1980s worsened the business environment. K Tire also underwent labor-management struggles but succeeded in straightening out one issue after another. In the meantime, the company chalked up a total output of 50 million tires, broke ground for its Koksung plant and completed its proving ground in preparation for a new takeoff.

In the 1990s, K Tire expanded its research capability and founded technical research centers in the USA and the United Kingdom to establish a global R&D network. It also concentrated its capabilities in securing the foundation as a global brand, by building world-class R&D capabilities and production systems. Even in the 2000s, the company maintained
its growth as a global company through continued R&D efforts by securing its production and quality capabilities, supplying tires for new models to Mercedes, Benz, Volkswagen and other global auto manufacturers.

3.3 Implementation of radio-frequency identification technology

RFID is radio-frequency identification technology to recognize stored information by using a magnetic carrier wave. RFID tags can be either passive, active or battery-assisted passive (BAP). An active tag has an on-board battery and periodically transmits its ID signal. A BAP has a small battery on board and is activated when in the presence of an RFID reader. A passive tag is cheaper and smaller because it has no battery; instead, the tag uses the radio energy transmitted by the reader. However, to operate a passive tag, it must be illuminated with a power level roughly a thousand times stronger than for signal transmission. That makes a difference in interference and in exposure to radiation.

RFID tags contain at least two parts:

1. an integrated circuit for storing and processing information, modulating and demodulating a radio frequency signal, collecting DC power from the incident reader signal, and other specialized functions; and
2. an antenna for receiving and transmitting the signal.

The tag information is stored in a non-volatile memory. The RFID tag includes either fixed or programmable logic for processing the transmission and sensor data, respectively. The RFID characteristics is varieties:

- capable of recognizing information without contact;
- capable of recognizing information regardless of the direction;
- capable of reading and saving a large amount of data;
- requires less time to recognize information;
- can be designed or manufactured in accordance with the system or environmental requirements;
- capable of recognizing data unaffected by contamination or the environment;
- not easily damaged and cheaper to maintain, compared with the bar code system; and
- tags are reusable.

3.3.1 Phase 1. Background of exploitation of radio-frequency identification (2005-2010).

Despite rapid growth of K Tire since 1960, K Tire ranked at the 13th place in the global market (around 2 per cent of the global market share) as of 2012. To enlarge global market share is desperate homework. K Tire was indispensable to develop the discriminated technologies. When bar code system commonly used by the competitors, and the industry leaders, K Tire had a decision for adoption of RFID technology instead of bar code system for tires as a first mover strategy instead of a late comer with regard to manufacture tires for personal vehicle. In fact, K Tire met two kinds of hardship. Among the top 20, the second-tier companies with market shares of 1-2 per cent are immersed in fiercer competitions to advance their ranks. The fierceness of the competition is reflected in the fact that of the companies ranked between the 11th and 20th place, only two maintained their rank from 2013.
With the demand for stricter product quality control and manufacture history tracking expanding among the auto manufacturers, tire manufacturers have come to face the need to change their way of production and logistics management. Furthermore, a tire manufacturer cannot survive if it does not properly respond to the ever stricter and exacting demand for safe passenger vehicle tires of higher quality from customers and auto manufacturers. As mentioned above, K Tire became one of the top 10 companies in the global markets, recording fast growth until the early 2000. During this period, K Tire drew the attention of the global markets with a series of new technologies and innovative technologies through active R&D efforts. Of those new products, innovative products – such as ultra-high-performance tires – led the global markets and spurred the company’s growth. However, into the 2010s, the propriety of the UHP tire technology was gradually lost, and the effect of the innovation grew weaker as the global leading companies stepped forward to take the reign in the markets. Subsequently, K Tire suffered from difficulties across its businesses, owing to the failure to develop follow-up innovative products or market-leading products, as well as the aggressive activities by the company’s hardline labor union. Such difficulties pushed K Tire down to the 13th position in 2014, which sparked the dire need to bring about innovative changes within the company.

3.3.2 Phase 2. Ceaseless endeavor and its failure (2011-2012). K Tire developed a wide range of top-class technologies inside and outside of South Korea. As such, success and development capabilities are institutionalized inside the organization, which are the driving forces in the attempt for new innovations. In the course of deciding to adopt RFID and developing the technology, the institutionalized organizational culture allowed K Tire to overcome the fear of failure and attempt technical innovation. To be adopted of RFID for tires, five phenomena are solved:

1. **It needs to be lightweight**: An RFID tag attached inside a vehicle may adversely affect the weight balance of the tires. A heavier tag has greater adverse impact on the tire performance. Therefore, a tag needs to be as light as possible.

2. **It needs to be durable**: Passenger vehicle tires are exposed to extensive bending and stretching, as well as high levels of momentum, which may damage a tag, particularly causing damage to or even loss of the antenna section.

3. **It needs to maintain adhesiveness**: Tags are attached on the inner surface, which increase the possibility of the tags falling off from the surface while the vehicle is in motion.

4. **It needs to be resistant to high temperature and high pressure**: While going through the tire manufacture process, a tag is exposed to a high temperature of around 200°C and high pressure of around 30 bars. Therefore, a tag should maintain its physical integrity and function at such high pressure and temperature.

5. **It needs to be less costly**: A passenger vehicle tire is smaller, and therefore cheaper than truck/bus tires. As a result, an RFID tag places are greater burden on the production cost.

Uncountable tag prototypes, were applied to around 200 test tires in South Korea for actual driving tests. Around 150 prototypes were sent to extremely hot regions overseas for actual driving tests. However, the driving tests revealed damage to the antenna sections of the tags embedded in tires, as the tires reached the end of their wear life. Also, there was separation of the embedded tags from the rubber layers. This confirmed the risk of tire separation, resulting in the failure of the tag development attempt.
3.3.3 Phase 3. Success of adoption RFID (2013-2014). Despite the numerous difficulties and failures in the course of development, the company ultimately emerged successful, owing to its institutional entrepreneurship and corporate entrepreneurship the government’s support. Owing to the government-led support project, K Tire resumed its RFID development efforts in 2011. This time, the company discarded the idea of the embedded-type tag, which was attempted during the first development. Instead, the company turned to attached-type tag. The initial stages were marked with numerous failures: the size of a tag was large at 20 × 70 mm, which had adverse impact on the rotation balance of the tires, and the attached area was too large, causing the attached sections to fall off as the tire stretched and bent. That was when all personnel from the technical, manufacturing, and logistics department participated in creating ideas to resolve the tag size and adhesiveness issues.

Through cooperation across the different departments and repeated tests, K Tire successfully developed its RFID tag by coming up with new methods to minimize the tag size to its current size (9 × 45 mm), maintain adhesiveness and lower the tag price. Finally, K Tire was success the adoption RFID.

3.3.4 Phase 4. Establishment of the manufacture, logistics and marketing tracking system. Whenever subtle and problematic innovation difficulties arise, every worker and board member moves forward through networking and knowledge sharing within intra and external.

While a bar code is only capable of storing the information on the nationality, manufacturer and category of a product, an RFID tag is capable of storing a far wider scope of information: nationality, manufacturer, category, manufacturing date, machines used, lot number, size, color, quantity, date and place of delivery and recipient. In addition, while the data stored in a bar code cannot be revised or expanded once the code is generated, an RFID tag allows for revisions, additions and removal of data. As for the recognition capability, a bar code recognizes 95 per cent of the data at the maximum temperature of 70°C. An RFID tag, on the other hand, recognizes 99.9 per cent of the data at 120°C.

K Tire, can construct its Manufacture, Logistics and Marketing Tracking System (MLMTS), which consists of infrastructures across various sections such as manufacture, logistics and marketing for the first time thanks to RFID adoption. The MLMTS receives and manages such information, which allows for sharing the information with others within the organization, as well as the customers. The MLMTS comprises four sections – manufacture, logistics and marketing – and the integrative server that integrates the three sections. The system for each section offers the following features:

- The manufacture and transportation information during the semi-finished product process before the shaping process is stored in the RFID tags, which is attached to the delivery equipment to be provided to the MLMTS;
- Logistics Products released from the manufacture process are stored in the warehouses, to be released and transported again to logistics centers inside and outside of South Korea. The RFID tags record the warehousing information, as the products are stored into the warehouses, as well as the release information as the products are released. The information is instantly delivered to the MLMTS;
- As a marketing, the RFID tags record the warehousing information of the products supplied and received by sales branches from the logistics centers, as well as the sales information of the products sold to consumers. The information is instantly delivered to the MLMTS; and
- As a role of integrative Server, MLM Integrative Server manages the overall information transmitted from the infrastructures for each section (production
Adoption of new technology for innovation

information, inventory status and release information, product position and inventory information, consumer sales information, etc.).

The MLMTS provides the company with various systemic functions to integrate and manage such information: foolproof against manufacture process errors, manufacture history and quality tracking for each individual product, warehousing/releasing and inventory status control for each process, product position control between processes, real-time warehouse monitoring, release control and history information tracking across products of different sizes, as well as link/control of sales and customer information. To consumers, the system provides convenience services by providing production and quality information of the products, provision of the product history through full tracking in the case of a claim, as well as a tire pressure monitoring system:

“South Korea’s K Tire Co. Inc. has begun applying radio-frequency identification (RFID) system tags on ‘half-finished’ tire since June 16. We are now using an IoT based production and distribution integrated management system to apply RFID system on our ‘half-finished products’ the tire maker said, claiming this is a world-first in the industry. The technology will enable K Tire to manage products more efficiently than its competitors, according to the company. RFID allows access to information about a product’s location, storage and release history, as well as its inventory management (London, 22, 2015 Tire Business).

4. Discussions
Originally, aims of RFID adoption for passenger car “half-finished product” is to chase the front runners, Hankook Tire in Korea including global leading companies like Bridgestone, Michelin and Goodyear. In particular, Hankook Tire, established in 1941 has dominated domestic passenger tire market by using the first mover’s advantage. As a late comer, K Tire needs distinguishable innovation strategy which is RFID adoption for passenger car’s tire, “half-finished product” to overcome shortage of number of distribution channels. Adoption of RFID technology for passenger car’s tire has been known as infeasible methodologies according to explanation by Changmin Park, vice-CTO (chief technology officer) until K Tire’s success.

We lensed success factors as three perspectives; institutional entrepreneurship, corporate entrepreneurship and innovation. First, as a corporate entrepreneurship perspective, adopting innovative technologies having uncertainties accompanies by a certain risk of failure. Corporate entrepreneurship refers to firm’s effort that inculcate and promote innovation and risk taking throughout its operations (Burgelman, 1983; Guth and Ginsberg, 1990). K Tire’s success was made possible by overcome the uncountable difficulties based on shared value and norms (e.g. Fligstein and Mara-Drita, 1996; Garud et al., 2002; Hargadon and Douglas, 2001; Maguire et al., 2004).

An unsuccessful attempt at developing innovative technologies causes direct loss, as well as loss of the opportunity costs. This is why many companies try to avoid risks by adopting or following the leading companies’ technologies or the dominant technologies. Stimulating corporate entrepreneurship requires firms to acquire and use new knowledge to exploit emerging opportunities. This knowledge could be obtained by joining alliances, selectively hiring key personnel, changing the composition or decision-making processes of a company’s board of directors or investing in R&D activities. When the firm uses multiple sources of knowledge (Branzei and Vertinsky, 2006; Thornhill, 2006), some of these sources may complement one another, while others may substitute each other (Zahra and George, 2002). Boards also provide managers with appropriate incentives that better align their
interests with those of the firm. Given the findings, K Tire seeks new knowledge from external organizations through its discriminative corporate entrepreneurship.

When adopting the RFID system for its passenger vehicle tires, K Tire also had to develop new RFID tags suitable for the specific type of tire. The company’s capabilities were limited by the surrounding conditions, which prevented the application of existing tire RFID tag technologies, such as certain issues with the tire manufacturing process, the characteristic of its tires and the price of RFID tags per tire. Taking risks and confronting challenges are made from board member’s accountability. From the findings, we find that entrepreneurship leadership can be encouraged in case of within the accountability framework.

Despite its status as a second-tier company, K Tire attempted to adopt the RFID system to its passenger vehicle tires, a feat not achieved even by the leading companies. Thus, the company ultimately built and settled the system through numerous trials and errors. Such success was made possible by the entrepreneurship of K Tire’s management, who took the risk of failure inherent in adopting innovative technologies and confronting challenges head on.

Second, institutional entrepreneurship not only involves the “capacity to imagine alternative possibilities”, it also requires the ability “to contextualize past habits and future projects within the contingencies of the moment” if existing institutions are to be transformed (Emirbayer and Mische, 1998). New technologies, the technical infrastructure, network activities to acquire the new knowledge, learning capabilities, creating a new organization such as Pioneer Lab and new rules to create new technologies are the features. To qualify as institutional entrepreneurs, individuals must break with existing rules and practices associated with the dominant institutional logic(s) and institutionalize the alternative rules, practices or logics they are championing (Garud and Karnøe, 2003; Battilana, 2006). K Tire established new organization, “Special lab” to obtain the knowledge stream among workers is more needed. Destruction of hierarch ranking system is proxy of the institutional entrepreneurship. Also, K Tire has peculiar norms. Namely, if one requires the further study such as degree course or non-degree course education services, grant systems operated via short screen process. Third, as innovation perspectives, before adopting the RFID system, the majority of K Tire’s researchers insisted that the company use the bar code technology, which had been widely used by the competitors. Such decision was predicated on the prediction that RFID technology would see wider use in the future, as well as the expected effect coming from taking the leading position, with regard to the technology.

Finally, K Tire’s adoption of the RFID technology cannot be understood without government support. The South Korean government has been implementing the “Verification and Dissemination Project for New u-IT Technologies” since 2008. Owing to policy support, K Tire can provide worker with educational service including oversea universities.

5. Conclusions and implications

To cope with various technological impasses, K Tire demonstrated the importance of institutional and corporate entrepreneurship. What a firm pursues more positive act for innovation is a research question.
Unlike firms, K Tire has strongly emphasized IT technology since establishment in 1960. To be promotion, every worker should get certification of IT sectors after recruiting. This has become the firm’s norm. This norm was spontaneously embedded for firm’s culture. K Tire has sought new ICT technology become a first mover. This norm can galvanize to take risk to catch up the first movers in view of institutional entrepreneurship.

That can be cultivated both by corporate entrepreneurship, referred to the activities a firm undertakes to stimulate innovation and encourage calculated risk taking throughout its operations within accountabilities and institutional entrepreneurship, referred to create its own peculiar norm. Contribution of our paper shows both importance of board members of directors in cultivating corporate entrepreneurship and importance of norm and rules in inducing institutional entrepreneurship.

In conclusion, many of them were skeptical about adopting RFID for its passenger vehicle tires at a time when even the global market and technology leaders were not risking such innovation, citing reasons such as risk of failure and development costs. However, enthusiasm and entrepreneurship across the organization towards technical innovation was achieved through the experience of developing leading technologies, as well as the resolve of the company’s management and its institutional entrepreneurship, which resulted in the company’s decision to adopt the RFID technology for small tires, a technology with unverified effects that had not been widely used in the markets. Introduction of new organization which “Special lab” is compelling example of institutional entrepreneurship. Also, to pursue RFID technology, board members unanimously agree to make new organization in the middle of failing and unpredictable success. This decision was possible since K Tire’s cultivated norm which was to boost ICT technologies. In addition, at that time, board of director’s behavior can be explained by corporate entrepreneurship.

From the findings, this paper also suggests importance of firms’ visions or culture from startup stage because they can become a peculiar norm and become firm’s institutional entrepreneurship. In much contemporary research, professionals and experts are identified as key institutional entrepreneurs, who rely on their legitimated claim to authoritative knowledge or particular issue domains. This case study shows that authoritative knowledge by using their peculiar norm, and culture as well as corporate entrepreneurship.

This paper has some limitations. Despite the fact that paper shows various fruitful findings, this study is not free from that our findings are limited to a single exploratory case study. Overcoming such limitation requires securing more samples, including the group of companies that attempt unprecedented innovations across various industries. In this paper, we can’t release all findings through in-depth interview and face-to-face meetings because of promise for preventing the secret tissues.

Nevertheless, the contribution of this study lies in that it shows the importance of corporate entrepreneurship and institutional entrepreneurship for firm’s innovative capabilities to grow ceaselessly.

References


Further reading


**Corresponding author**

Junghee Han can be contacted at: hjh0037@hongik.ac.kr
A study on effect of entrepreneurship on entrepreneurial intention
Focusing on ICT majors
Cheolwoo Park
Catholic University of Busan, Busan, South Korea

Abstract
Purpose – The purpose of this study is to show effect of entrepreneurship on entrepreneurial intention. Currently, the long-term global economic crisis is accelerating, and the concerns for future uncertainties are spreading throughout our society. The ICT majors in Busan region are no exception so that business start-up is being considered as a new alternative to survive and grow in such uncertain environments at home or abroad. That is, business start-ups and entrepreneurship are being emphasized as a strategy that individuals can change not only one’s own life but also the fate of a region and even the destiny of a country.

Design/methodology/approach – For this reason, the youth start-ups based on social networks and leadership have become the focus of our social concern along with the entrepreneurship that can actively cope with the ever-changing global environments. Thus, some of the major factors (i.e. innovation, enterprise and risk-taking) which should be considered when promoting the entrepreneurial intention of the ICT majors in Busan region have been researched, as well as the concept of entrepreneurship itself.

Findings – This demonstrates that young people will be able to successfully lead their start-up companies through their enterprising spirit, networks and leadership and learning with firm determination. Therefore, it is important to make such a network and leadership-based entrepreneurship become foundational in overcoming the long-term Korean economic depression; surviving in such an opaque situation; leading the growth and development of Busan region; and becoming the driving force for national growth, by developing the unique characteristics and strength of the students.

Originality/value – In this regard, this study will be useful for understanding the entrepreneurship of the ICT majors in Busan region more while contributing to the invigoration of a creative economy by studying the factors essential for the entrepreneurship and development of networks and leadership.

Keywords Leadership, Entrepreneurship, Entrepreneurial intention, Network

Paper type Research paper

1. Introduction
Currently, the concerns for uncertain future due to a long-term economic depression and global economic crisis are spreading throughout our society. Moreover, along with the trend in industrial scale downsizing and profit generation with a small manpower cost, concerns about the increase of youth unemployment due to jobless growth are deepening. According to National Statistical Office of Korea, the youth unemployment rate reached the highest
Many countries agree that the business start-ups are the solution for youth unemployment so that our government is also expending much effort in developing the policies to stop the increase in youth unemployment rate and create more jobs by instilling youth entrepreneurship and creating a positive atmosphere for business start-ups in this grave period of low economic growth. This method is important and also useful in maintaining steady economic and social growth. The young people at present are living in an era where a variety of new businesses are being continuously launched through internet media, and industries are developing according to the stretch of the imagination for contents and software. Thus, this study attempts to identify what factors of entrepreneurship affect innovative start-ups like ICT-based businesses that are quite effective in creating jobs.

2. Research background

2.1 Concept of entrepreneurship

Since the dawn of the twenty-first century, the importance of entrepreneurship started to be recognized as an element of promoting economic growth so that the researches for finding how entrepreneurship contributes to the growth have become active. The definitions mainly used for the studies related to entrepreneurship are as following: “Seizing an opportunity regardless of available resources” (Stevenson and Jarillo, 1986); “The way of inferring, thinking and behaving focusing on overall approach and specific leadership based on the importance of recognizing the opportunities” (Timmons, 1999); and “The spirit of challenge and adventure that commercializes the opportunities seized at risk” (Peter F. Drucker). Meanwhile, Hisrich and Peters (1998) described entrepreneurship as a discernment that an enterpriser considers necessary, rather than defining it as his/her psychological state. Song (2011) defines the term as an enterpriser’s will to create a new business through management innovation by showing his/her challenging spirit. Park and Ahn (2016) explained to the young CEOs that entrepreneurship is an important factor in improving their business performances, and they need to expend the effort to cultivate their business competency. Although the definition of entrepreneurship varied depending on the situations which individual business, country or generation faced, the definition mainly used for recent studies is Miller’s (1983) concept of definition which states that entrepreneurship is a behavior that re-combines or re-distributes resources with innovativeness, enterprising spirit and risk-taking mind to create a new value. The core of entrepreneurship is a positive energy that challenges or changes existing conventions by acutely responding to the changing environments with an innovative and creative mind. Cultivating entrepreneurship for young people will be effective in solving the problems concerning youth unemployment, low and falling economic growth rates while contributing to Korean economic growth.

2.2 Elements of entrepreneurship

There are varied opinions about the elements of entrepreneurship among the scholars. Schumpeter (1939) defined entrepreneurship as the driving force of modernization having the characteristics such as innovation-seeking spirit, pro-activeness and risk-taking tendencies. Lassen et al. (2006) distinguished the characteristics of entrepreneurship as autonomy, adventurousness, innovativeness and future-orientation. Based on the recent detailed and systematic researches conducted for the nature of entrepreneurship, the definition of entrepreneurship by Miller (1983), who has claimed that the elements such as pro-activeness, innovativeness and risk-taking consist entrepreneurship, became the dominant view. Thus, this study also considers these three characteristics as core elements.
2.2.1 Innovativeness. Van de Ven (1992) defined that innovativeness, which can be regarded as the most critical element of entrepreneurship, is an organizational and cultural management to recognize the necessity of new ideas and behaviors, while Lumpkin and Dess (1996) maintained that it is a crucial element for promoting new products and services, novel experience, technological leadership, R&Ds for new methods and creativeness. Meanwhile, Lee (1999) argued that innovativeness is one that an organization emphasizes the technological innovation or actively conducts product designing, market survey as well as product advertisement through product or market innovation based on process innovation and experimental management technique. Kang (2011) suggested that innovation is one of the elements of entrepreneurial strategies which can be an important means of promoting investments for consistent development of new technologies and improvement of products to gain a competitive advantage. Therefore, with all of these definitions and contentions, innovativeness should be considered as a critical element of entrepreneurship with which companies can adapt themselves to the rapidly changing environment in the age of forth industrial revolution.

2.2.2 Risk-taking. Risk-taking is one’s or organization’s desire to actively capture and pursue opportunities in an uncertain environment accepting the risks involved. Jung (2015) defined this term as a risk preferring decision-making behavior in an uncertain environment. While the entrepreneurs with low risk-taking tendency try to avoid risks or make decisions cautiously, ones with high risk-taking inclination tend to make decisions faster to capture opportunities (Bin and Park, 2002). Meanwhile, Sexton and Bowman-Upton (1986) maintained that risk-taking indicates the degree of entrepreneur’s will or tendency to boldly challenge uncertainties or enjoy them. Risk-taking is meaningful only if an entrepreneur is proactive in seizing an opportunity, not just accepting the risks.

2.2.3 Pro-activeness. Pro-activeness is a future-oriented disposition that allows an entrepreneur to forecast future when he is supposed to make a decision strategically. The entrepreneur takes active behaviors after forecasting future opportunity and market demands. Lumpkin and Dess (1996) maintain that pro-activeness means a company preoccupying the market opportunity or holding a predominant position in the market. Thus, with pro-activeness, companies develop new products and attempt to find new opportunities in a highly uncertain environment or actively endeavors to secure a leading/discriminative position in a newly created market (Kim, 2015). Covin and Slevin (1991) claimed that pro-active entrepreneurs compete more aggressively than the others. This means that they are not just simply counteracting their competitors but also consistently trying to introduce some new products/services development and management techniques into their companies. That is, pro-activeness can be defined as a tendency or behavior of actively participating in the market changes one step ahead of their competitors (Kim, 1994).

2.3 Leadership
It is possible to say that leadership is an important element in many success factors for start-ups and their continuous growth, but it is not easy to define them with a few words and its definition varies depending on the approaches taken individual researchers. Bass (1990) considered leadership as an interaction process among the group members to structure or restructure their perceptions and expectations. Meanwhile, Northouse (2013) defined leadership as a process where an individual attempt to affect group members to achieve their common goal. However, Katz and Kahn (1978) defined it as one’s influence that allows to produce more results than the results obtained from just carrying out everyday orders. A strong leadership that leads to harmonious and organized business activities is essential to
achieve more than expected. This study attempts to analyze and substantiate the impact of a strong leadership on the entrepreneurial intentions and the success of start-ups.

2.4 Network
In a complex information-oriented society like present, it is not easy for small-scale companies to satisfy economic demands while maintaining their competitiveness just by themselves, as they often lack some of the necessary resources. Creative ideas and networks are essential for achieving a successful business performance.

Huggins and Johnston (2010) claimed that it is indispensable to use some of the external resources to surmount the difficulties in start-up businesses caused by the lack of internal resources. Similarly, Choi (2010) supported this by suggesting that start-ups will be able to optimize their performance by using the resources they lack by establishing some external networks. According to Jang (2013), the network activities that can be regarded as the personal and social activities of an entrepreneur refer to the behavior of using external resources for his/her start-up process depending on his/her internal capability. The importance of networks and their roles are being emphasized in many types of research conducted for start-ups. Thus, this study also attempts to identify how network establishment and their activities affect the entrepreneurial intention of ICT majors in Busan area.

2.5 Entrepreneurial intention
The concept most widely used to understand the phenomena associated with the establishment of a business is entrepreneurship. Analyzing the definition of entrepreneurship found in Morris’s (1998) studies, it was possible to find that entrepreneurship has been often emphasized when one plans to establish a company. Yoon (2004) considered entrepreneurial intention as the first step in establishing one’s business and a positive attitude and experience toward business start-up should be preceded prior to actually making a decision to start his/her business. Krueger et al. (2000) defined entrepreneurial intention as an individual’s effort to start his/her business so that without it, one would not be able to proceed further. Considering that starting a business can be fulfilled through calculate and intentional activities, the first step, entrepreneurial intention, is essential for understanding overall phenomena involved in business start-up, as it is a key element in determining the early characteristics of start-ups (Bird, 1988; Katz and Garter, 1988). Shapero (1981) claimed that the roles of entrepreneurs with entrepreneurial intentions are important for the nation, region or organization to have their power of recuperation to ride out economic downturns and self-reforming traits. Therefore, it is important for our society to contribute to continuous economic growth by inculcating a positive perception in the minds of students with entrepreneurial intentions to promote and activate start-ups and let the ones with potentials to challenge and succeed.

3. Research method
To study the magnitude of influence factors of entrepreneurship of Busan-area ICT majors over their entrepreneurial intentions, we have randomly extracted the samples from the ICT majors in Busan area during the period from November 1, 2016 to February 15, 2017. A five-point scale was used for the survey. A total of 250 questionnaires were distributed, and 147 (71.70 per cent) of them were collected eventually, excluding unreliable responses. For the empirical analysis of influence factors, the SPSS 23.0 program was used. Based on the study model shown in Figure 1, a series of hypotheses were developed to deduce the influence factors and put to verification afterward.
4. Result of empirical analysis

In this study, the effect of the independent variables, entrepreneurship, leadership and network promotion factors on entrepreneurial intention were analyzed using Pearson’s correlation analysis. The result of the analysis shows that the correlation coefficient between network and entrepreneurial intention is very high, and overall, the measurement factor has a positive (+) relationship Table I.

A multiple regression analysis was used in this study to verify the effect of facilitating factors of entrepreneurship on the entrepreneurial intention (dependent variable). Here, independent variables were also included for analysis (i.e. simultaneous input).

From the results obtained from the multiple regression analyses performed against all the respondents, the applied regression equation was effective in explaining the dependent value, as the overall explanatory power for activation of entrepreneurial intention was 49.4 per cent, $F$-value of analysis model was 38.352 and $P$-value 0.000. Also, as the variance inflation factor (VIF) showed the maximum value of 1.616 while minimum tolerance was 0.619, it was determined that there was no multicollinearity problem. Specifically, the factors such as pro-activeness in entrepreneurship, leadership, and network were analyzed to the statistically significant variables at $P = 0.05$. However, innovativeness and risk-taking factors were excluded at this level. Observing the relative effect of each independent variable on entrepreneurial intention through a standardized regression coefficient, the pro-activeness in entrepreneurship was most influential (=0.603) from the positive (+) side Table II.

For the study, some hypotheses for the influential factors of entrepreneurship which should be considered to promote the entrepreneurial intentions of ICT majors in Busan area have been developed and put to empirical analysis using a statistical technique. First, as for the verification by regression analysis, $H1$, which assumes that entrepreneurship will give a positive influence on entrepreneurial intention was partially accepted compared to leadership which was fully accepted. Innovativeness and risk-taking in $H1-1$ and $H1-3$, respectively, were rejected as they did not have a positive influence, whereas pro-activeness ($H1-2$) was accepted. Such results are quite the contrary to the results presented in Hwi-Yeol Choi’s (2016) study where he concluded that innovativeness and risk-taking tendencies had a significant influence on entrepreneurial intention while pro-activeness did not. This may
### Table I.
The correlation analysis for the effect of entrepreneurship on entrepreneurial intention.

<table>
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<tr>
<th>Measurement factors</th>
<th>Innovativeness</th>
<th>Pro-activeness</th>
<th>Risk sensitivity</th>
<th>Leadership</th>
<th>Network</th>
<th>Entrepreneurial intention</th>
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### Measurement factors

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<th>Innovativeness</th>
<th>Pro-activeness</th>
<th>Risk sensitivity</th>
<th>Leadership</th>
<th>Network</th>
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**Note:** **The correlation is significant at 0.01 level (two tailed)**
have resulted from the fact that his survey was conducted for the general college students rather than for the ICT majors. The difference is that this study has targeted the ICT majors who have sufficient knowledge and experience that the high-tech industries involving artificial intelligence, robotics or other cutting-edge technologies can lead to a social innovation after being internalized as a foundation of our current society. It is true that the knowledge associated with the 4th Industrial Revolution and in their potentials also contributes to such an innovation. Thus, this study has empirically proven that both innovativeness and risk-taking are not that influential, at least for the ICT majors in Busan area.

Meanwhile, \( H1-1 \) was accepted such that it is possible to determine that pro-activeness of entrepreneurship has a positive influence on entrepreneurial intention. This result is consistent with most other research results which concluded the same (Yoon, 2012b; Park and Kim, 2009; Yoon, 2012a; Kim, 2016). Pro-activeness can be considered as the tendency that actively solves problems by positively dealing with changes and pursues something distinctively novel to find new opportunities. The above result also means that pro-activeness is necessary for all the business founders for them to occupy a dominant position in a fluid and rapidly changing market on the threshold of the 4th Industrial Revolution.

Next, for the \( H2 \), the studies on correlations between leadership and entrepreneurial intention are quite insufficient in the ROK. Yoo (2014a, 2014b) and Kang and Ha (2015) are the typical researchers who claim that leadership has a significant influence on entrepreneurial intentions. Likewise, this study accepted the hypothesis that assumes the same.

Finally, as for the \( H3 \), most of the researches conducted for entrepreneurial intention find that network(s) do have a positive influence on entrepreneurial intention (Burt, 1992; Yoo, 2012; Yoon, 2004) also maintains that the network environments are essential for producing a large number of start-ups. These researchers verified that various types of networks actually stimulate entrepreneurial intention. As these precedent studies, the hypothesis in this study which made the same assumption was accepted. This means that a practical and operational network(s) are vital to students’ business success. It is also true that entrepreneurial intentions can be highly inspired when the student business founders themselves endeavor to understand and perceive various aspects of start-ups by actively participating in a variety of experimental environments or network/leadership activities with a positive mind and attitude (Table III).

5. Conclusion and policy proposal

Current young people in the Republic of Korea (ROK) are in the midst of the 4th Industrial Revolution which goes beyond the information-oriented society. This new era focuses on a

<table>
<thead>
<tr>
<th>Category</th>
<th>Non-standardized coefficient</th>
<th>Standardized coefficient</th>
<th>Multicollinearity statistic</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Standard error</td>
<td>( \beta )</td>
</tr>
<tr>
<td>Entrepreneurship</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Innovativeness</td>
<td>0.044</td>
<td>0.077</td>
<td>0.043</td>
</tr>
<tr>
<td>Pro-activeness</td>
<td>0.519</td>
<td>0.070</td>
<td>0.603</td>
</tr>
<tr>
<td>Risk-taking</td>
<td>0.036</td>
<td>0.049</td>
<td>0.051</td>
</tr>
<tr>
<td>Leadership</td>
<td>0.526</td>
<td>0.066</td>
<td>0.551</td>
</tr>
<tr>
<td>Network</td>
<td>0.227</td>
<td>0.065</td>
<td>0.241</td>
</tr>
<tr>
<td>( R^2 )</td>
<td>0.708</td>
<td>R^2 0.501</td>
<td>( R^2 _adj. ) 0.494</td>
</tr>
</tbody>
</table>
variety of novel ideas including artificial intelligence and advanced robotics. The ROK government and most Korean universities should foster intelligence information industry to respond to the requirements of this era and enhance global competitiveness of start-ups by promoting an appropriate start-up ecosystem to create more jobs. Many developed countries around the world view creating quality jobs as the most important measurement for conflict resolution and income imbalance. Developed countries such as the EU, America, Japan and as well as emerging countries such as China are pursuing on the development of existing industries and the creation of new industries as core policies (Ministry of Science, ICT and Future Planning, 2014) based on ICT development. The Korean government also needs to make efforts, basing on ICT, to expand the employments and also the number of young entrepreneurs who have a proper entrepreneurship or a challenging spirit to contribute to the national economy. Thus, a study was conducted to determine what factors of entrepreneurship promote the entrepreneurial intention of ICT majors in Busan area. Also, an empirical analysis was performed by deducing the factors that need to be considered to activate the entrepreneurial intention in the universities. The existing factors that affected the entrepreneurial intention of university students were mostly structurally defined ones such as entrepreneurship education, support policies for start-ups and relevant educations which would drive the students to pursue start-up businesses. However, these factors, or impact categories, were often theoretical and indoctrinating that they were somehow ineffective as a base for creating jobs for college students or realizing the creative economy. For this reason, the importance of entrepreneurship which can give a positive impression to these people’s entrepreneurial intentions has been studied and verified not only in prior treatises (Byong Geun, JO 2013, KIM, 2016 etc.) but also in this research paper.

In the study, pro-activeness of entrepreneurship was found to be most influential to students’ entrepreneurial intentions. In Finland, innovative entrepreneurs are deliberately cultivated based on the saying, “entrepreneurs are not born but are trained through education”. This means that without entrepreneurship education, students’ entrepreneurial spirit cannot be cultivated (Park, 2010). This paper also considered that efforts to review the means to foster pro-activeness at the practical level and expanding them are critical to improving the entrepreneurial intentions of the students. It has been also verified that the substantive indirect experiences such as leadership and network activities are highly influential to the entrepreneurial intentions of ICT majors. Existing studies (Yoon, 2004; Yoo, 2012) showed that establishment of networks from which the students can receive help while they are preparing for their start-ups or afterward are significantly important to the improvement. This study also proves that, which is focused on ICT departments in Busan, the student with high pro-activity and enhanced leadership actually respond more effectively to the difficulties or the fluidal variables during their start-up preparations than those who received the lecture-oriented start-up education. Therefore, entrepreneurship education that will boost pro-activity and practical experience which can lead to actual start-ups are essential, in addition to well-trained leadership

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Accept/reject</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>H1. Entrepreneurship will have a positive influence on entrepreneurial intention</strong></td>
<td>Partially acceptable</td>
</tr>
<tr>
<td><strong>H1-1. Innovativeness will have a positive influence on entrepreneurial intention</strong></td>
<td>Rejected</td>
</tr>
<tr>
<td><strong>H1-2. Pro-activeness will have a positive influence on entrepreneurial intention</strong></td>
<td>Accepted</td>
</tr>
<tr>
<td><strong>H1-3. Risk-taking will have a positive influence on entrepreneurial intention</strong></td>
<td>Rejected</td>
</tr>
<tr>
<td><strong>H2. Leadership will have a positive influence on entrepreneurial intention</strong></td>
<td>Accepted</td>
</tr>
<tr>
<td><strong>H3. Networks will have a positive influence on entrepreneurial intention</strong></td>
<td>Accepted</td>
</tr>
</tbody>
</table>

Table III. Verification result of hypothetical influence factors of entrepreneurship on entrepreneurial intention
and well-organized networks. The government and relevant authorities should focus on providing more diverse educational programs to invigorate youth start-ups, and we expect that this study will be useful for that purpose.

References


Further reading


Corresponding author
Cheolwoo Park can be contacted at: cwpark@cup.ac.kr

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An exploratory study of innovation strategies of the internet of things SMEs in South Korea

Dong-Il Shin
Konkuk University, Seoul, South Korea

Abstract

Purpose – This study aims to suggest directions for innovation-driving paths for sustainable growth through an in-depth case analysis of a successful Internet of Things (IoT) in small- and medium-sized enterprise (SME) in South Korea. IoT is expected to play a significant role in the future industry 4.0 platform. Yet, little is known about how SMEs in the IoT industry (IoT-SMEs hereafter) pursue innovation in alignment with attributes inherent in the IoT.

Design/methodology/approach – This study addresses relatively unexplored key research questions on innovation strategies of IoT-SMEs. To do so, we employ an exploratory research methodology, along with an extensive review of the literature in the areas of the IoT, SMEs innovation and sustainable growth strategy. Specifically, we conduct intensive individual interviews to find IoT inherent innovation attributes and a case study to explore the process of linking these attributes to innovation-driving paths.

Findings – The analysis results reveal that there exist disruptive and open innovation attributes in the IoT industry that enable IoT-SMEs to enhance their structure and process related capabilities, to create business models for products and services and to collaborate with external parties in marketing to enter the market. We excavate practical insights into driving innovation based on IoT attributes and suggest enabling paths for pursuing innovation and entering overseas markets for IoT-SMEs.

Originality/value – This study investigates an underexplored significant area of research on the relationship between IoT attributes and innovation paths. The findings provide profound theoretical and practical implications. To the best of the author’s knowledge, it is the first attempt to link disruptive and open IoT attributes to innovation paths of IoT-SMEs. The results provide directions for pursuing effective innovation in responding to the IoT market for sustainable growth.

Keywords Disruptive innovation, Open innovation, Value chain, Born global, IoT (Internet of things)

Paper type Research paper

1. Introduction

The Internet of Things (IoT), appeared in “Staff working paper on IoT” in 2008, is considered a part of the Future Internet (2009) in accordance with the European Union (EU) Framework Program[1]. Rapidly rising as a major industrial issue in the global trend, the IoT is foreseen to play a key role in not only industrial paradigm shift but future
management change and innovation. Observing this global trend, the Korean government has been actively supporting the IoT as well as Information and Communication Technologies (ICT) industry development through the Korea Information and Communication Technology (K-ICT) strategy crafted in 2015. In China, we find a case study of logistics and manufacturing small- and medium-sized enterprises (SMEs), urging them to apply knowledge management and transform to learning organizations, given that the IoT will dramatically change the landscape of logistics and manufacturing (Li & Lu, 2010).

The global market is now being transformed into a platform-based competition for market dominance. Korean IoT-SMEs (SMEs in the IoT industry) are facing serious challenges as to making a strategic choice of whether to keep the status quo or transform for growth. The IoT connects various value chains, hence influencing one another (Kim & Jung, 2013) and necessitating companies to cooperate. Therefore, it is critical to perform an in-depth analysis of innovative IoT-SMEs, which can help identify the attributes inherent in the IoT and aid decision-making through the analysis of current situations and characteristics of companies.

In Korea, 99 per cent of manufacturing SMEs lack in implementing the network and information service-based Business Model (BM) required by the IoT industry (WIPO, 2015)[2]. In accordance with the 2013 Organization for Economic Cooperation and Development (OECD) data, the average survival rate of the Korean startup companies is 62 per cent in the first year of establishment and only 41 per cent in three years, the lowest among OECD member countries (Kauffman Foundation, 2015)[3]. Further, the average three-year survival rate in the entire industry is as low as 38.2 per cent in 2013, based on the statistics from the National Statistical Office (KOSTAT, 2015), raising a critical issue of sustainable survival as well as entrepreneurial startups. As a new trend of the IoT has foreseen a global market reorganization, a red light is on to Korean SMEs entering the global market (stat.kita.net). An open innovation policy study shows that successful SMEs in open innovation activities mainly utilized joint R&D, networking for technology and market information gathering and technology consulting, and that in terms of cooperation types, bilateral cooperation is twice as much as multilateral cooperation (Kang et al., 2013). However, little research is finding that investigates IoT attributes and linking them to innovation paths for IoT-SMEs.

Therefore, this study intends to analyze the conceptual definition and attributes of the IoT industry and present policy implications through an exploratory study of Innovative Korean IoT-SMEs that have secured the growth base by linking these attributes. Further, as the advent of numerous emerging industries such as ICT, Big Data, artificial intelligence (AI) and Industry 4.0 urgently demands Korean SMEs today to develop effective strategic plans for innovation, this study aims to assess their limitations of looking at the existing IoT industry responding to the changes and provide a new perspective of driving innovation to IoT-SMEs.

2. Review of the IoT research
2.1 Conceptual definition of the IoT
The IoT is a concept and paradigm for thinking about things in an environment where various objects and subjects are connected by wire and wireless (IERC, 2013). The definition of the IoT varies by major organizations and corporations and by global standard organizations such as International Telecommunication Union (ITU), 3rd Generation Partnership Project, Institute of Electrical and Electronics Engineers, European Telecommunications Standard Institute have different definitions. These international organizations and the nations’ major institutions reflect their own interests in defining the concept. For example, ITU interprets the IoT as an intelligent environment in which communication modules embedded in devices and objects are connected to a wired or wireless network, enabling information exchange and communication
between people and objects and among objects (ITU-T, 2005). Recently we have observed is a trend toward standardization initiated by ITU-T IoT-GSI (ITU Telecommunication Standardization Sector IoT Global Standards Initiative), ITU-T JCA-IoT (ITU-T Joint Coordination Activity-IoT), ISO/IEC JTC 1 (a joint technical committee of the International Organization for Standardization and the International Electrotechnical Commission) and the Internet Engineering Task Force IoT. It is anticipated that the IoT era is coming as the things are getting miniaturized and smart with the advances in ICT-based technologies (Kim and Jung, 2013).

In the case of IoT-SMEs in Korea, many of them view the IoT as the advanced radio-frequency identification (RFID), Ubiquitous or ICT on the internet. The National Information Society Agency, 2013, anticipates that “in the future society, everything will be connected to the Internet through the mobile and communicate with one another”. The IoT is the base technology and service of the hyper-connected society and a concept that has been extended to the IoE (Internet of Everything), starting from the existing Ubiquitous Sensor Network (USN) and the object intelligence communication Machine to Machine (M2M). Conceptually, these terms show similarity in terms of network connectivity and information sharing among things. The IoT can be defined as an object-space connected network servitized based on mutual intelligent relationship formation through cooperation, sensing, information processing and exchange and networking among objects without or with the least amount of human intervention.

2.2 Characteristics of the IoT research
Korean companies’ interest in the IoT was very low in 2013, staying at only 15 per cent in search by Google Trends (trends.google.com). In the study of IoT companies’ overseas expansion strategies conducted in 2014, only half of the companies out of 40 companies interviewed expressed negative interest in the IoT industry (Deltatech Korea, 2014). However, by 2015, this situation has changed drastically with the sharp rise of the interest in the IoT.

Early previous research on the IoT in Korea focused on technological change contexts (Nam, 2010; Kim et al., 2011). This research trend has advanced into a study on the value chain of the IoT (Moon, 2013; Kim et al., 2011) and then the research suggesting the direction of success in the IoT industry through a quantitative effect analysis (Jeong et al., 2013). There were studies of proposing the application sectors of the IoT and the expansion trend of target objects (Chun, 2014) and future IoT technology characteristics (Choi et al., 2014). Also, there were studies focusing on infrastructure for commercialization support such as security risks (Kang, 2014) and mitigation of prior regulations (Kwon et al., 2014).

Unlike those studies, a study focusing on the impact of the IoT industry (Kim and Lee, 2014) has emerged in 2014. Especially, the viewpoint that the IoT technology can change a company’s position or the industry attractiveness has contributed to our present research by identifying the latent attributes of the IoT. Also, there were studies on major issues and directions of the IoT technology development (Lee et al., 2014) and specific development plans for improving utilization and satisfaction of IoT users (Lee et al., 2015). However, it has been difficult to find the research literature that suggests ways for Korean IoT-SMEs to approach and respond to the changes in the industrial paradigm caused by the IoT.

2.3 Challenges to overcome market situations by utilizing the advantages of SMEs
The advantages of SMEs are in their innovativeness, flexibility, and cooperation to respond quickly to changing environments (Carson et al., 1995; Gilmore et al., 2001; Hill, 2001; Laforet & Tann, 2006; Simpson et al., 2006). However, there are also drawbacks such as a lack of resources and experts (Carson et al., 1995; Gilmore et al., 2001), unplanned and too simplistic
nature (Carson & Cromie, 1990; Fuller, 1994; Hogarth et al., 1996) and lack of marketing capability in effectively deploying innovative products in the marketplace (O’Dwyer et al., 2009; Hatonen & Ruokonen 2010; Hausman, 2005). Thus, IoT-SMEs are required to establish a market entry strategy that maximizes their advantage to access highly competitive markets with a limited customer base because it is difficult to secure reliability in a rapidly evolving and uncertain market environment. Further, to compete against large companies with stable brands and international reputations in the market, SMEs should do so through innovation for survival (Salavou, 2004). Recognizing the limitations in the domestic market, it is natural for technology-based SMEs to pay attention to the innovation-generating capacity and the ability to create opportunities abroad (Harris, 1988; Keeble, 1997). Then, it is crucial to investigate how SMEs commercialize technology products in highly competitive environments (Acs & Audretsch, 1990; Borg, 2009; Hatonen & Ruokonen, 2010). Therefore, our study focuses on how to create synergy by linking the advantages of IoT-SMEs with innovation attributes of the IoT industry.

3. Research design and methodology

The purpose of this study is to analyze and present the findings of the critical elements and characteristics of Korean IoT-SMEs to enter and succeed in the overseas market through product and service innovation in the changing IoT environment. It is because many of the Korean IoT-SMEs have not yet realized the impact and importance of the IoT despite the advent of a new industrial paradigm called IoT. Moreover, as the Korean government has established a medium- to long-term support policy, it is necessary to investigate whether IoT-SMEs are actively responding to the IoT and making progress. In addition, if the overseas expansion is essential for Korean IoT-SMEs, it is necessary to analyze what their positions and status are and what their approaches and response strategies are.

To do so, we employ an exploratory research methodology such as individual interviews and case study, along with an extensive literature review. First, through the extensive literature review, we examine the scope of the IoT and innovation and growth potential of the IoT industry by analyzing innovation attributes, ecosystem and market structure. Second, through the intensive individual interviews of 40 Korean IoT-SMEs in 2014, we identify what their positions and status are in terms of their views, capabilities and preparation effort toward overseas market expansion, and what their approaches and response strategies are to cope with the changes in industry paradigm. Third, through an in-depth case study of a successful Korean IoT-SME in 2016, we analyze the process of driving innovation to discover the critical elements and the alignment between IoT attributes and innovation paths for achieving sustainable growth in the IoT industry. Through the above analyses, we intend to better understand IoT innovation attributes and propose an effective innovation and growth strategies for IoT-SMEs in responding to changing environments.

The primary research question of this study is:

**RQ1.** What strategic choices do IoT-SMEs have for sustainable growth?

The basic premise behind this question is that the achievements of IoT-SMEs will be effective if they understand the attributes of innovation within the IoT industry and drive innovation according to their intended goal. Thus, we specifically propose the following research questions in a series:

**RQ2.** What innovation attributes are inherent in the IoT industry?

**RQ3.** What types of innovation-driving path do IoT-SMEs choose for their survival and growth?
RQ4. What patterns exist between IoT innovation attributes and innovation-driving paths of IoT-SMEs for achieving their intended goals?

4. Characteristics and innovation attributes of the IoT industry

4.1 Characteristics of the IoT industry

The common concept of the IoT industry can be summarized as minimizing human intervention, connectivity and networking. Unlike the existing industries, the IoT industry exhibits such characteristics as universality, infinite scalability and continuous innovativeness, given its base on data. In accordance with IEEE (2015), its scope includes 16 fields (stakeholders) in eight markets, whereas Beecham Research, CISCO (2014) and Global Sensor Networks, Tata Consultancy Service, KISA (2012) have different scope by classifying business categories such as IoT components differently.

The keen interest in the IoT market is because it enables the existing ICT ecosystem to expand and secure long-term growth potential of the industry. In accordance with the Korea Internet Promotion Agency (2012) and OVUM (2011), the value chain of the IoT consists of semiconductor, chip, module, device, platform, network and service, while Gartner (2013) classifies it into horizontal technology market and the vertical industrial sector market and in the horizontal technology market, semiconductor, software and service are considered the three most important platform technologies understood as IoT value chain-based technologies. The research on the IoT-related value chain and market component (Kim & Jung, 2013) and prioritization of application areas in the value chain (Moon, 2013) provide good implications to IoT-SMEs in making strategic decisions.

The IoT-related business ecosystems are rapidly evolving. The number of the internet startups increased from 792 in March 2015 to 3,365 in March 2017 (https://angel.co/internet-of-things). In addition to industrial manufacturers such as GE, Siemens, Bosch and Philips, large companies in the ICT field such as Cisco, Intel, Apple and Samsung are participating, and M&As in IoT-related fields are also increasing (www.prweb.com/releases/2015/01/prweb12424187.htm). Further, the participation of companies in Asian-Pacific region is increasing in the US- and Europe-based IoT ecosystem such as Withings, Sigfox and Netatmo.

The IoT ecosystem in Korea is composed of government public institutions, specialized technology transfer institutions, domestic product and service companies and overseas brand companies, with platform and cloud service at the center (see Figure 1). In the case of government public institutions, it is linked to specialized technology transfer institutions mainly by application products and services, and relates to overseas brand companies through a network. In the case of domestic product and service companies, they are connected to solution delivery business and system integration business with specialized technology transfer institutions, and they are also connected to overseas brand companies with device products. These are linked to the value chain and integrated into the platform and delivered as a cloud service.

Considering the future market in 2022, the application market is the largest at US $1.194tn, whereas the growth rate of the solution providers and system integrators is much higher than that of the application and services, with its annual average growth rate of 66.1 per cent in 2013-2022 (STRACORP, 2013). In this regard, it is necessary for Korean IoT-SMEs and venture companies to carefully examine the necessity of forming a partnership by precisely grasping their own capabilities considering the position and dynamics of the global leading companies in the IoT Ecosystem. Also, the choice of a value chain to understand the link with the surrounding ecosystem is very important. Thus, our study
proposes an effective pathway to localization needed for developing a global market entry strategy.

4.2 Innovation attributes of the IoT industry

In the IoT industry, there are two inherent innovation attributes: disruptive innovation attributes (Ma and Zhang, 2011; Frost & Sullivan, 2014; Telecom Asia Vision, 2016; Beth, 2016) and open innovation attributes (Boon & Looi, 2015; AnupSahoo, 2016; An & Chun, 2015; Kang et al., 2014). The National Information Commission (NIC: National Intelligence Council) in the USA selected the IoT as one of the “Disruptive Civil Technology” that will affect national competitiveness by 2025, and Korea’s Ministry of Science, ICT and Future Planning has supported the IoT industrial ecosystem by inducing open partnership of win–win cooperation through an open platform. The US Open Census (OpenSensors.io) has demonstrated the potential of data sharing analysis and service innovation by analyzing the causes to a problem based on real-time accumulated data and suggesting an approach to problem-solving (Oxford Flood Network). The innovations that are potentially inherent in the IoT industry start from the infinite possibilities of “data”. This is also related to the connection properties of the IoT.

4.2.1 Disruptive innovation attribute. Unlike sustaining technology that values the performance improvement of existing products demanded by demanding customers, disruptive technology makes potential consumers easier to use and provides relatively simple low-end products. Disruptive technology is an innovation strategy that can never be achieved without lowering the cost of parts, reducing manufacturing costs and shortening the development time. This attribute is inherent in the IoT industry, and thus, various devices such as wearable devices, drones, smart home, health care and smart city are emerging from various sensors and semiconductor chips. It helps to predict the arrival of industry growth and innovation business. To successfully pursue innovation strategies in such a situation, it is necessary to utilize Resources, Processes and Values (RPV) theory (Christensen et al., 2004). It is because companies can succeed by using resources, processes
and opportunities that meet their values. In addition, it is necessary to understand and cooperate with the resources and value chain among the IoT companies.

D’Aveni (1994) proposed a creative market disruption model as an innovation strategy for companies under hypercompetition and suggested a vision, capability and tactics for disruption. In addition, Prahalad and Mashelkar (2010) pointed out disrupting business models, modifying organizational capabilities and creating or sourcing new capabilities as critical elements that enable a breakthrough innovation.

4.2.2 Open innovation attributes. In the IoT industry whose infrastructure consists of connectivity characteristics of networking, dynamics within the value chain and the formation of ecosystems, there is an inherent open innovation attributes (AnupSahoo, 2016). At The Association of Southeast Asian Nations (ASEAN) IVO Forum 2015 of National Institute of Information and Communication Technology, Boon and Looi (2015) suggested the adoption of open platforms for IoT solution and application development that cooperate through “IoT Innovation Platform” and anticipated that the platform would accelerate industry growth. In addition, they expected that the cooperation of the IoT based on the open innovation platform would contribute to the creation of the ASEAN innovation ecosystem and market value. The Journal of Information and Communication by the Korea Information Society Agency mentioned the need for a software-centric infrastructure that supports open innovation in the hyperconnected society through the “hyperconnected social infrastructure that accepts open innovation”.

Kang et al. (2014) predicted that efficient sharing of resources would be achieved through advanced wired and wireless networking in an open software-centric virtualized cloud. The open innovation trend supports the inclusion of more networks and the harmonious expansion of the ecosystem by constructing an open platform for the IoT. It also promotes open partnerships to enable radical innovation. It is important to note that the IoT already has the property to accommodate the existing innovation theory. The IoT, the value chain of which consists of such elements as chips, sensors, modules, devices, equipment, networks, communications and services, requires cooperation and technical convergence within the value chain and connectivity and communication with external ecosystems. These attributes connect a smart home to the household appliance industry, smart farm to the agriculture, livestock, forestry and fishery industries and smart car to the automobile industry. This implies the importance of the cooperation strategy for companies to survive and achieve sustainable growth in the IoT industry.

4.3 The capabilities of IoT-SMEs for linking IoT attributes with innovation-driving paths 4.3.1 Network capability and positioning-based response capability. To properly select and utilize an innovation attribute inherent in the IoT, companies need to respond appropriately and secure necessary capabilities, that is, networking capability—the fundamental attribute of the IoT—and ecosystem adaptation capability. Companies can craft a step-by-step response strategy, such as incremental innovation, but what is required in a changing environment of new industrial paradigm, is rapid and precise responses. In the study of SMEs in Russia, which has undergone very rapid changes in recent decades, Kyllikki et al. (2014) pointed out SMEs’ need to adapt to the rapidly changing environment and secure networking capability as well as inner capability. These factors can be similarly applied in industrial environments where the IoT is applied.

In addition to networking capability, it is necessary to understand the surrounding ecosystem and to decide which positioning-based response to take. Kapoor and Adner (2015) argued that the success of new technology depends on the degree of completeness of the ecosystem to which the technology will be applied. An example of establishing technology
ecosystem is found in sales hybrid cars and electric cars. They appeared at similar times, but hybrid cars accounted for 84 per cent (1.65MM) of total sales volume (1.95MM) of environment-friendly cars, while electric vehicles accounted for only 8.9 per cent (Korea Automotive Industry Research Institute. 2014).

4.3.2 Internationalization capability. Internationalization capability is a capability needed for survival and adaptation that SMEs can consider and choose to overcome the limitation in domestic market size. Esteve-Pérez et al. (2007), who analyzed small and medium manufacturers in Spain from 1990 to 2002, suggest that export-oriented SMEs are more likely to survive than SMEs focusing on the domestic market. Similar results are found in Bernard and Sjoholm (2003) and Melitz (2003).

There are also findings that born global companies can make profits through the learning effects from exploring international market opportunities and capitalization (Autio et al., 2000). Lee et al. (2012), in their study of 1,612 Korean venture SMEs, discovered that the technology asset does not have a direct effect on survival, but R&D alliances do, and that internationalization provides survival opportunities. Thus, to increase survival rate, alliances with external resources, which give more opportunities to contact with external resources, are more important than internal resources, based on resource-based view.

4.4. Innovation-driving paths of IoT-SMEs

4.4.1 Characteristics of innovation-driving paths of IoT-SMEs. Innovation originating from the Latin “inovare” that means “creating something new” is considered a way of changing opportunities into new ideas and making them widely used. The types of innovation have been introduced over include product and process innovation, radical and incremental innovation, system innovation, component innovation, technology driven and market driven innovation, closed and open innovation (Hoffman et al., 1998). In the Oslo manual, the types of innovation refer to product, process, organization and marketing innovation (OECD, 2005). However, it is difficult to find studies related to innovation models specific to SMEs, and most studies have focused mainly on entrepreneurial and structural characteristics (Hoffman et al., 1998). According to Laursen and Salter (2004), there is no evidence that large firms are more likely to innovate than SMEs in an entirely new type of innovation, and these results indicate that SMEs also have the capacity to make innovation, especially radical innovation.

Unlike those studies arguing that firm size does not affect innovation activities (Soete, 1979; Freeman, 1982; Rothwell & Zegveld, 1982), some studies assert that technology and demand characteristics are more important to firm innovation (Pavitt, 1984; Pavitt et al., 1987). Although the findings show that there is no correlation between firm size and technology innovation and that SMEs can adapt to changing environments more rapidly through their flexibility, they need to collaborate with other companies due to their lack of capabilities dealing with total innovation (Edwards et al., 2005). SMEs are in the important position in the country and at the center of the policy that drives economic development as the backbone of regional industries (Jones & Tilley, 2003).

4.4.2 The innovation-driving paths type of IoT-SMEs

4.4.2.1 Step-by-step growth. The early model of innovation explains innovation activities as those of several functional activities performed step-by-step from a simple and psychological form (Tidd et al., 2015). Thus, innovation is understood as a process by which the desired form of innovation is made in the way you think. Rothwell (1992) suggested that historical perceptions of innovation attribute evolve from a single-line model (characteristics in the 1960s) to a complex interaction model. He viewed innovation as a multi-player
through the concept of “5th generation innovation” and mentioned that this activity becomes easier as IT development improves internal and external integration level.

Scott and Bruce (1987) mentioned the evolution through survival and growth as the type of innovation in SMEs and classified the problems and growth patterns of SMEs from a perspective of survival and step-by-step growth evolution. He found that SMEs exhibit differences in size and growth capability and have such characteristics as independence of behaviors, differences in organizational structure and diversity of management styles. In addition, pointing out that the same problem is usually experienced at the growth stage, consisting of “Existence”, “Survival”, “Success”, “Growth or Take-off” and “Resource Maturity” and that not all companies are going through this entire process. Then they suggested how SMEs have overcome the crisis of survival and need cooperation in the transition from growth to maturity.

This type of step-by-step growth is consistent with incremental innovation and step-by-step internationalization theory and can be defined as self-evolving type. The representative innovation activities include independent R&D, product technology and process innovation, core competencies and RPV-based innovation activities.

4.4.2.2 Open innovation. The type of open innovation-based collaboration in SMEs can be classified into outside-in (e.g. insourcing, collaborative research, venture investment, technology procurement, research contract, long-term support, joint venture, M&A), inside-out (e.g. technology asset sales, spin-off, project result release) and coupled collaboration (Enkel et al., 2009; Bok, 2006; Kim et al., 2008). Gemunden and Heydebreck (1995) argue that the greater the firm size, the greater the level of external cooperation, especially the collaboration with universities and research institutes.

Parkhe (1993) also analyzed empirically that firm size shows a significant correlation with the degree of technological sophistication and intent of joint research and development. Egelhoff and Haklisch (1994) argued that the smaller the firm size, the stronger the tendency to avoid open innovation and collaborative research. Further their empirical study found that product development alliances increase as companies move from introduction to growth to maturity in industry life cycle.

Prior research showed that firm collaboration affects their performance and that the degree of collaboration differs by the stages of firm growth. This type of driving innovation can be defined as a type of alliance-based collaboration, and it can expand the capabilities that companies have in terms of technology development through joint R&D activities or market entry and enhance effectiveness.

4.4.2.3 Mixed type: step-by-step growth combined with open innovation. Technology cooperation of SMEs in terms of the method, partner, motivation and the change in content is considered important, as they can influence the technical performance of a company (Jeong & Bae, 1997). Hiromi Saito (2010) investigated 10,731 companies in Japan and discovered their mixed R&D characteristics which is considered absorptive capacity and defined as “mixed type” because mixed R&D requires innovation activities based on platforms and networks, the capability that a company has must reach a certain level required for cooperation. The core of this mixed model lies in collaboration with external resources based on its own capabilities rather than relying solely on outsourcing.

4.4.2.4 Global partnership. Kanter (1994) presented various partner relationships in terms of strength and closeness of cooperation. This study is important from a value chain partnership perspective, as the concept extends to value chains in other industries beyond that in the same industry. Thus, SMEs needs to have such perspective when they are trying to establish global partnerships.
For SMEs, it is difficult to enter the overseas market even though it is required. Although the government supports global partnerships to develop overseas markets, the reality is that SMEs are passive, as they cannot find the market or lack in capabilities or the business model is not prepared for partnership. Previous research on overseas expansion has focused on venture firms’ entry into overseas markets, types of entry and achievements (Coviello & McAuley, 1999; Fillis, 2001; Rialp et al., 2005; Zahra, 2005; Zahra & George, 2002). In the previous studies on the international management activities of venture companies, venture business startups have focused on the individual dimension of the management (Burgel & Murray, 2000; Oviatt & McDougall, 1995) or domestic industry characteristics and local market characteristics, as key drivers (Femhaber et al., 2007; Karagozoglu & Lindell, 1998; Smith et al., 2000). These studies emphasized that the growth of the domestic market is stagnant, the level of competition is stronger, the market growth rate is faster in local countries and the internationalization of venture companies is more advanced when the competition level is low. Other studies based on resource-based view have focused on the resources and capabilities of venture firms (Knight & Cavusgil, 2005; Zahra et al., 2003) and relational capability or social capital to complement the inherent limitations of venture firms (Yli-Renko et al., 2002; Zain & Ng, 2006).

5. Exploratory study
5.1 Interview results of Korean IoT-SMEs
To clarify more clearly the situation of IoT-SMEs in Korea, we conducted concurrently the field visits and telephone interviews of 40 companies during September 2014. The content of the individual interviews focused on the awareness and response situation of domestic IoT businesses, the necessity and timing of overseas expansion (Table I).

The outcome showed sharp contrast, having 20 companies with negative perceptions and the other 20 companies with positive perceptions (14 companies expressing strong interest in overseas expansion and 6 companies expressing that they would wait and see). Only 15 companies (37.5 per cent) expressed confidence in BM they developed and 31 companies showed the interest in partnering or searching for ones to enter the global market.

The more firms that have failed in R&D investment and business such as RFID and USN, the more negative the tendency to enter the overseas market is. Although those companies that have been active in overseas expansion have modified their positions in the value chain or have already designed or commercialized specific BMs, most companies have not prepared for BM concept yet. Those companies that are considering overseas expansion, expect to receive the government support of education and consulting so that they can creatively develop a BM.

The interviews show that the current situation in the IoT industry is very unclear to the IoT-SMEs. As the companies have different levels of capabilities in different situations, a new approach is required, different from the existing R&D and export support policies. By

<table>
<thead>
<tr>
<th>Classification</th>
<th>Interviewed firms (by sales)</th>
</tr>
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<tbody>
<tr>
<td>Sales (Unit: 100m KRW)</td>
<td><del>10 10</del>30 30<del>50 50</del>100 100<del>500 500</del>1000 1,000~</td>
</tr>
<tr>
<td>Number of firms</td>
<td>5 4 2 3 9 5 12</td>
</tr>
</tbody>
</table>

Table I.
Participating IoT-SMEs in interview by sales volume

Notes: In accordance with the Enforcement Decree of the Framework Act on Small and Medium Enterprises Article 3, among the interviewed companies, there were 30 firms with sales of less than 150bn KRW in IoT industry.
comparing and analyzing the status and competence level of these interview companies, we found that Korean IoT-SMEs need to understand innovation attributes of the IoT, select the market, product and the innovation-driving path and plan and execute innovation and internationalization.

5.2 Case study of an innovative Korean IoT-SME

We conducted a case study for Nuri Telecom, a systems software developer and supplier for 24 years since its start in 1992 whose name was changed to Nuri Telecom in 2000. As a Korean IoT-SME with sales of 30bn KRW and a patent in the field of remote meter reading, it has developed its own solution and made a growth engine. It is one of the representative IoT companies in Korea that did not stay as a single product manufacturer in the domestic market and continues to grow and innovate as a set maker and solution service provider. We will examine the response strategy of Nuri Telecom from a viewpoint of IoT attributes, which overcame the limitations in the domestic market through overseas market expansion by forming global partnerships and has strived for development of a new BM and cooperation in technology development to compete in the global market.

5.2.1 Internationalization: developing overseas market based on own R&D capability.

Nuri Telecom, which originated from the software in the early days of its founding, has developed hardware through the development period of seven years, pioneered the remote meter reading device market in Korea, developed CDMA and delivered it to KEPCO. Since then, they have focused on program development and became a set maker of Full Set manufacturing, succeeding in developing a product package. Now they are facing more competition (KT, LG U+, etc.) in the field. After changing to “Nuri Telecom Co., Ltd.” and aiming at overseas market within one year, it became the top export company in the domestic remote meter reading device market. Although it continues to do the business of RFID that is the foundation of M2M IoT and has the capability to build the equipment and solution modem from the bottom to the top, now it is more of a service company than the equipment and solution company with the proportion of services (70 per cent) and solutions (30 per cent).

Nuri Telecom has the top-level technological capability of achieving the reading success rate of 99.8 per cent in the test for its finished product in Sweden. The first example of M2M that it pursued is a remote meter reading device, which is an IoT solution product. The network equipment is constructed as a mesh network by mesh method, so that it can establish a flexible network that can be restored even if any one of them is damaged. In the AMI (Smart Grid) product line, which is an area of automatic meter reading device, exports accounted for more than 50 per cent of total exports in 2015. As a product standard, AMI’s share of exports grew from 41.1 per cent in 2014 to 65.6 per cent in 2015, and exports accounted for 69.3 per cent in the third quarter. In terms of products, AMI exports accounted for 18.7 per cent in 2014 and increased to 30.7 per cent in 2015, and the proportion of exports of RFID was increased in 2016.

5.2.2 Open innovation: cooperation with external parties and responses.

In the global market, Nuri Telecom is securing its competitiveness by partnering with large companies to deal with global competitors. In addition, the company could achieve sustained survival and growth with its strategy of securing price competitiveness and self-maintenance capabilities as well as various deployment cases. Currently, in the USA, large companies such as Itron and Silver Spring Networks are present with their installation of one million households, and there are more than 30 larger competitors. In contrast, Nuri Telecom covers a range from 100,000 to 300,000 households, but they have low-cost systems and price competitiveness. Thus, global companies also recognize Nuri Telecom as a competitor. Even
in the more competitive heavy electric power sector, in the case of power generation, entering the consortium is the only way and the forces are not yet formed. Therefore, they need to participate in the market to be involved in the standard so that it can be within the entry barriers.

Symbol Technology, Alien, Matrics, Philips and TI are among the world's leading suppliers of RFID systems. In November 2004, Nuri Telecom was selected as a partner for Motorola (M&A of Symbol Technology) and Premier Solution and has actively conducted RFID and automatic recognition business. The survival strategy that Nuri Telecom considers and prepares in the IoT era is the response to the standard and cooperation. Europe requires to specify the standard and asks to back up its standard later if it is not there yet. Nuri Telecom follows the M2M international standard, and it is common for overseas customers to make a request first.

All electricity and service networks in Korea are tailored because electricity is post-paid. In contrast, in overseas, a prepayment system is common, and there are many places that use the charge system and the electricity is cut off when the charge is finished. Therefore, it is important to check the remaining charge with an electric shut-off meter or a charging system. Nuri Telecom is currently cooperating with 13 major companies. The disadvantage of collaborating with these partners is that Nuri Telecom has to conform to their specific standards. Therefore, Nuri Telecom has always been developed and distributes products considering these standards because it is necessary to change these standards when entering the overseas market. If it does not meet the standards, Nuri Telecom will always be asked by buyers to explain the reasons and future strategies. At present, Nuri Telecom has its own customization capability to meet overseas standards and certification.

5.2.3 Disruptive innovation: BM development and response. It is the BM that Nuri Telecom is prepared for the global market. In Korea, it is common to receive a new concept, but overseas markets are being asked to present a BM. It is very important to respond quickly to technical standards or BM depending on the country, and Nuri Telecom has strong competitiveness in this respect. In the process of doing business, Nuri Telecom is aware of the need for a new BM of the rich or poor countries, and it is currently expanding its business in developing countries. In the places where the cooperative relationship exists among the global consultative body, there are large corporations that maintain cooperative relations in developing data bases (DBs) and chips. There are also companies in competitive relations. The future farming is moving toward smart farm. In this area, Japan has M2M capability. Nuri Telecom is preparing for the technology roadmap and continue to refine it over the next three years.

Technology has been developed through continuous modification and chip development is a great know how. These technologies are difficult to disclose and do not yet have to be shared or released. For example, in the case of a chip, it is a perfect solution when it is required to make a correction. This takes a lot of time and requires combining various points of view. Large companies that collaborate demand sharing of these technologies, but in that case, it is difficult to keep the business together. To strengthen its own capabilities, it provides strong compensation for developing patents inside to secure them, and the R&D research team conducts company R&D by participating in national R&D. Solution development is also a result of obtaining the national R&D order. Thus, it has a commercialization process in technology development and operates a separate team for this.

5.2.4 Moving from self-evolving type to the mixed type in driving innovation: response from the technology development perspective. Among the total 56 patents, registered based on applicants, it holds eight registered patents related to telecommunication and possesses strong competence in terms of technology. It usually carries out independent R&D, but it
also conducts joint R&D although it is rare. However, as the need for security technology development is raised through recent interviews, it judges that there is an increasing need to cooperate with security technology companies to develop technologies to replace existing foreign solutions. This judgment is based on recognition that past R&D alone is difficult to survive in the global market competition, and shows that outside-in innovation is required through cooperation with external parties.

In the case of RFID, USN and IoT, the technology required in terms of internal capabilities is security technology. This technology is used by purchasing the foreign solution, and thus the cooperation is urgently needed to secure it.

Nuri Telecom considers the need for an energy storage system (ESS) system technology that saves energy by using big data. It ponders on how to provide a competitive solution and service to energy management solution (EMS) in the electricity, water and gas energy management. Although there are overseas branches, it is difficult to publicize and there are many strong competitors. Thus, it is necessary to make a pilot. However, it is also a big problem that large companies are not interested in.

5.3 The implication

Through the above literature review and case analysis, we examined various attributes such as connectivity, universality and scalability of the IoT, and the disruptive and open innovation attributes. It has also been found that there are characteristics that cause radical changes in the products and organizations, and changes in manufacturing processes. The case study revealed that the innovation-driving and growth paths of the successful IoT-SME in Korea has an effective alignment between the IoT innovation attributes and the innovation-driving paths.

The first stage of the innovation-driving path is the step-by-step growth through self-evolution. As a representative of RFID M2M, considered a predecessor of the IoT, it shows a viable early stage innovation path to secure its own R&D capability and grow as a set maker in the domestic market. The second stage of the path is the aligned cooperative growth that embraces open innovation and utilizes strategic partnerships during internationalization. In recognition of the limited demand in the domestic market, it has continued to survive and grow through partnerships with large companies in terms of open innovation to secure a competitive advantage in the global market while aiming for internationalization. In this process, the case company has established strategies for securing demand-oriented standards, by recognizing that ecosystem survival strategies in the IoT industry require the response to the standard and cooperation and, of course, it is also an important factor that enhances its own capacity for internationalization. The third stage is the preparation of the BM as a disruptive innovation for sustainable growth in the global market. This gives a new market value to existing products for smart consumers, smart cities and smart factories, and it is a new viewpoint in the market but not a new technology. The fourth stage is the shift in technology innovation perspective. The case company is moving from the initial self-evolution type through the medium-term cooperation to the mixed type of driving innovation. It has secured the IoT related patents, preferring independent R&D, but recently it has been working on joint R&D, recognizing the necessity to cooperate with external parties as its business scope expands.

In the above case, the innovation path, which the Korea’s IoT-SME has followed while maintaining their survival and growth for 24 years after changing their mission, was achieved by selecting strategies and types appropriate to the situation. This provides many implications for companies in the field. The specific path that played a major role in securing
the basis for sustainable growth can be summarized as the self-evolving stage followed by an aligned cooperative growth stage and then by the mixed stage.

5.4 Discussion of the innovation-driving path

5.4.1 The self-evolution path type: self-empowerment. This study suggested the paths of driving innovation to SMEs which are trying to enter into the IoT industry so that they can effectively prepare for and respond to environmental changes. It is since early startups, especially those that are not ready for a proper BM or overseas expansion, might be wondering what innovation-driving path they need to choose and why. In such case, it is imperative for SMEs to go back to the basics of following the step-by-step innovation for self-evolution, preparing for BM and strengthening capabilities for overseas market entry. It is desired for the government to provide SMEs with methods and tools for analyzing Big Data and providing information on IoT development environment of and market and technology trends to aid their decision making and enhance their capabilities.

5.4.2 The aligned cooperative path type: strategic partnerships during internationalization. The aligned cooperative path type, whether linked with disruptive or open innovation attributes, is a strategy that can be considered for companies which are trying to leap up by expanding capabilities through proprietary technology competency or innovative BM. Such companies need to adapt their capabilities to the global market goals and to seek cooperation with related companies in the value chain. The government also needs to provide a strategic guidance to IoT-SMEs so that they can derive a new BM to maximize the possibility of success in the market by matching the companies with excellent ideas and those with manufacturing competencies in the enterprise pool.

Alliance and cooperation within the value chain and the consideration of external ecosystems enable companies to develop a global market-oriented BM based on disruptive innovation. Those companies can reduce the costs of parts and manufacturing and shorten the development time which cannot be achieved by “sustaining technology”. They can provide a simple product called “low-cost entry model” to low-end market customers. If they understand the IoT innovation attributes well, they can achieve service innovation and business innovation by providing the value that customers want.

5.4.3 The mixed innovation-driving path type: securing sustainable growth base. The mixed innovation-driving path type, combining self-evolution path and aligned cooperative path, can be considered in large companies or companies with various businesses. In this case, if the company collaborates with external parties based on its core competencies, its performance can be significant and is closely linked to the characteristics of open innovation. Since this path plays a key role in the creation of the IoT ecosystem, it is an appropriate strategic choice to those competent companies such as hidden champions and leading companies in the value chain.

How companies respond to the future will influence the Korean IoT-SME industry in developing new competencies for sustainable growth. For this, it is necessary to establish a global partnership with network, equipment and solution groups using the platform focusing on the IoT value chain and to advance in the market based on this mixed innovation driving path. Cooperation with companies within and across the IoT value chain is useful for BM discovery, and most of all, for sharing information on environmental changes and sensing market needs. Collaborative research among companies will be effective for creating synergy.
6. Concluding remarks

The primary focus of this study was on the survival of the Korean IoT-SMEs and the path of driving innovation for growth. Korean SMEs have been achieving innovation and growth in the traditional manufacturing sectors. However, as industries such as ICT, Big Data, IoT and Industry 4.0 have emerged recently, not only manufacturing SMEs but also IT-related companies are in the critical needs of adapting to changes. As such, the main motivation behind this study of dealing with the survival and innovative growth of IoT-SMEs lies in the fact that these companies are an important part of the infrastructure for building the ecosystem of the future industry.

In this study, we presented the factors for the IoT-SMEs facing the new environmental change to consider in making a strategic choice of the innovation-driving path type for their survival and sustainable growth. We found that the IoT has inherent disruptive and open innovation attributes. We also discovered that a successful IoT-SME has followed an innovation-driving and growth path consisting of self-evolution, aligned cooperation and their mix.

The IoT-SMEs in Korea are facing challenges in global market entry. The first obstacle is the lack of information to sense and judge the market situation. The lack of diverse information, which hinders decision making, makes it difficult for them to accommodate market needs. The second is the lack of capability to find a suitable BM. The IoT can lead to great results if synergy is created through close linkages with the intra or across the value chain companies. Those companies that produce chips, sensors, terminals, networks, equipment and platforms are playing the key roles in the IoT value chain. It is important for companies to understand their role in the value chain and cooperate with the partners within and across the value chain. It is also critical for the companies without global market entry experience to create partnership and establish communication environment with experienced companies in the global market. This is the very sector where government support policy is needed in identifying environmental changes and global market trends and deriving a suitable BM for new markets. The support that enables creating more synergistic results does not have to be for companies with certain size, but for the companies within and across the value chain.

This study has its meaningful merit in that it suggested a new point of view to establish an innovation-driving path to enter overseas markets by linking IoT innovation attributes. However, the limitation in this research is in using a single case study for the analysis to find an innovation-driving path. The future research need to replicate this study by investigating multiple cases of IoT-SMEs, for validating and enhancing this study findings. This study can be applied to large IoT companies to see whether there is a difference in innovation-driving path. Finally, it will be desirable to conduct studies for other emerging industries involving AI, big data, Industry 4.0 and product-service convergence of XaaS (Everything as a Service).

Notes

1. Some perspectives in this study are based on “Research on the advancement of IoT related companies in foreign countries” of the Ministry of Science, ICT and Future Planning, 2014.11.30.
2. In WIPO’s Global Innovation Index 2015, Korea ranked 14th in the world’s competitiveness ranking and 2nd in Human Resources and Research, whereas Business sophistication ranked 30th and Creative Outputs 28th.
3. The Kauffman Foundation analyzed the percentage of OECD peers whose businesses started in 2006 in 2007 and 2009, respectively.
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**Website**

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**Corresponding author**

Dong-Ill Shin can be contacted at: sdi@csdicon.net

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Understanding IPTV churning behaviors: focus on users in South Korea

Myung-Joong Kim
Seoul, South Korea

Juil Kim
Division of R&D Budget Strategy,
Korea Institute of S&T Evaluation and Planning (KISTEP), Seoul, South Korea, and

Sun-Young Park
Department of Management of Technology, Konkuk University,
Seoul, South Korea

Abstract
Purpose – This study aims to investigate customers’ churning out of Internet Protocol Television (IPTV) service, one of the most prevalent forms of IT convergence.

Design/methodology/approach – Based on the review of current literature, a research model is introduced to depict the effects of select independent variables on customer churning behavior. First of all, the two groups are compared in terms of predictor variables, including switching barriers, voice of customer (VOC), membership period and degree of contents usage. Then, a curvilinear regression was applied to understand the association relationship between the level of IPTV contents usage and variables of switching barriers, VOC and membership period. Third, a logit regression was performed to predict customer churning behavior through the variables of switching barriers, VOC, membership period and level of IPTV contents usage.

Findings – Through the empirical analysis, this study analyzed the factors affecting customer churning behavior of IPTV service providers based on switching barriers, VOC and contents usage.

Originality/value – Although several studies on IPTV have been undertaken globally, they have largely depended on self-reporting surveys to examine dynamics between antecedent variables and IPTV performance in terms of customer satisfaction, usage intensity and customer retention. This empirical study is performed to understand influential factors of IPTV service defection through the weblog analysis of 3,906 service users, who represented both service defectors and non-defectors during a specific month.

Keywords Switching barriers, IPTV, Churning behaviour, VOC, Contents usage

Paper type Research paper

1. Introduction
Digital convergence is accelerating. It is taking place in many different forms, including voice and data network merger, voice over IP (VoIP) and IP-enabled television (or IPTV).
The internet and its technology are in the epicenter of the accelerating digital convergence. The disappearing boundaries between the traditional mass media and network service industries, especially in the form of IPTV (Internet Protocol Television), are probably one of the most striking examples of the rapid development of digital convergence. Digital convergence in such service brings changes to service providers (e.g., service cost, market competition, customer service strategy), service users (e.g., user behaviors, lifestyle, convenience, utility of service functions), national infrastructure and economy and society (e.g., culture). That is, digital convergence poses challenges and opportunities to businesses, as it disrupts established paradigms. As it sets itself apart from the traditional service paradigm in many different ways, digital convergence warrants dedicated research.

As a representative service riding on the convergence tsunami, IPTV offers service functions that have not been available from the traditional TV service, spawning new and disruptive business models. In Korea, IPTV’s popularity has exploded, surpassing 13 million subscribers in April 2016 after its commercialization less than 8 years ago (Korea IPTV Broadcasting Association, 2016) (Ministry of Science, ICT and Future Planning, Korea Association for ICT Promotion, Korea Electronics Associations, 2016). Now, its adoption is about to enter the maturity stage after going through the rapid growth. Although several studies on IPTV have been undertaken globally, they have largely depended on self-reporting surveys to examine dynamics between antecedent variables and IPTV performance in terms of customer satisfaction, usage intension and customer retention. To the best of our knowledge, none of them has studied customer defection behaviors based on actual usage records of IPTV service, and our research intends to fill the gap.

An empirical study is performed to understand influential factors of IPTV service defection through the weblog analysis of 3,906 service users, who represented both service defectors and non-defectors. First of all, the two groups (i.e., those who defected vs those who stayed) are compared in terms of predictor variables, including switch barriers, voice of customer (VOC), membership period and degree of usage. Then, a curvilinear regression was applied to understand the association relationship between the level of IPTV usage and variables of conversion barriers, VOC and membership period. Third, a logit regression was performed to predict customer churning through the variables of conversion barriers, VOC, membership period and level of IPTV usage. Through the empirical research, we offer strategic insights into the effective management of IPTV customers.

2. Theoretical background and literature review

2.1 IPTV

2.1.1 Definition and characteristics. An IPTV has its own IP address and, through a set top box, a PC or TV receives the content service including real-time broadcasting and VOD (video on demand) over the high-speed internet connection (Bouwman et al., 2008). The basis of IPTV, thus, is IT convergence on which it performs the traditional TV function – i.e., contents are broadcasted in uni-direction by service providers – and also offers other advanced features such as personal choice of TV programs tailored to customers’ needs, internet commerce, web search and email (Kim and Yoon, 2004). By combining traditional TV provisioning with the rich set of internet-enabled information/commerce functions, IPTV is frequently called “Internet Protocol TV”, “Interactive Personal TV” and “Intelligent Program TV”. As can be seen, IPTV affords multi-channel interactivity between service providers and consumers, offers personalized services over the point-to-point channel rather than broadcasting and fuses other advanced digital services, including VoIP (Hong and Lee, 2007; Yu et al., 2011).
2.1.2 Previous studies. Previous studies of IPTV are largely divided into those that investigate technology aspects, including technology trend analysis and proposition of new technology (Vidal et al., 2010; Lopez et al., 2011), policy analysis and development (Ezeh et al., 2012; Lee and Shin, 2009) and service issues (Bouwman et al., 2008; Blasco-Arcas et al., 2012). This study focuses on a service issue that has important strategic implications on IPTV marketing by service providers. Table I summarizes current literature on IPTV research conducted from the perspective of service provision. The literature review reveals that current works examine IPTV service-related issues mainly from four different angles: service adoption intention, service quality and satisfaction, service prediction and contents.

Those of service adoption intention analyze and predict how internal and external service factors affect adoption intention of prospective customers. As IPTV service is still in its early stage of market growth in many parts of the world, understanding what antecedents influence IPTV adoption has been an important research issue to service providers. In that regard, a number of studies attempted to study the association between IPTV adoption intention and explanatory variables through survey research (Shin, 2007; 2009; Blasco-Arcas et al., 2012; Choi et al., 2010; Lee et al., 2012; Pezzi, 2010; Weniger, 2010; Sawng et al., 2014a; Schreider et al., 2010; and Motohashi et al., 2012).

According to them, there are various quality dimensions – e.g. system quality, contents (or information) quality, service quality and degree of customization – that positively affect people’s attitude toward IPTV adoption and usage (Blasco-Arcas et al., 2012; Lee et al., 2012; Shin, 2007; Shin, 2009; Sawng et al., 2014a; Weniger, 2010).

Studies of service quality and satisfaction investigate the influence of service quality variables on the satisfaction of IPTV customers. Empirical studies conducted in different contexts confirmed that service quality is an important antecedent of user satisfaction (Oliver, 1993; Cronin and Taylor, 1992; Anderson and Sullivan, 1993; Spreng and Mackoy, 1996). This strong relationship has not been an exception in IPTV research (Jan et al., 2012; Nasir and Khan, 2014; Motohashi et al., 2012). According to the studies, perceived quality of service (QoS) manifested in such dimensions as channel speeds and packet loss recovery significantly affects customer satisfaction (Nasir and Khan, 2014). Also, it was reported that IPTV service providers and subscribers have discrepant perceptions on the quality dimensions of the same service (Jan et al., 2012). Besides, such factors as functional resemblance between services, complementary, substitution effects (Sawng et al., 2013), perceived values (Lin et al., 2012), system and user interactivity and customizability (Blasco-Arcas et al., 2011) have been examined as influencing factors of IPTV service satisfaction.

Studies of service prediction diagnose and characterize current status of IPTV deployment through different research methods such as scenarios, focus group interviews and literature reviews of IPTV technology, market situations and policy in place and apply them to predict its future. Several studies assert that interactivity is a key in furthering future growth of IPTV service (Choi et al., 2010; Zeadally et al., 2011), and that business models evolve around interactivity and customization aspects of service contents (Zeadally et al., 2011).

Research on IPTV contents analyzes characteristics of available information contents and attempts to investigate ways to grow their consumption by subscribers – a key to the success of IPTV business models. Attractive contents are not only a magnet to IPTV adoption but also can fetch additional revenues to service providers through other transactional activities. As related, people may be more active in consuming paid contents when they participate in VOC and watch IPTV for longer hours (Sawng et al, 2014b). It is also pointed out that IPTV contents tend to resort to higher sensationalism in delivering interactivity and individual customization (Lin et al., 2014). Despite this, improvements may
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<td>Shin (2009)</td>
<td>Usefulness/system quality/content quality/enjoyment/attitude/intention</td>
<td>Telephone survey of potential IPTV users</td>
<td>System quality and contents quality positively affect service attitude. Also, service attitude is positively associated with usage intention.</td>
</tr>
<tr>
<td></td>
<td>Shin (2007)</td>
<td>Intrinsic factors/extrinsic factors/economic factors/demographics/adoption intention</td>
<td>Survey of potential IPTV users</td>
<td>Special functions, customized contents, interactivity, value added service, interoperability, service experience are significant indicators of IPTV adoption intention.</td>
</tr>
<tr>
<td></td>
<td>Blasco-Arcas et al. (2012)</td>
<td>Interactivity/personalization/user participation/user intentions to continue participating/user involvement in the service purchased</td>
<td>Survey of non-IPTV service users (college students)</td>
<td>It was found that personalization is more effective than interactivity in promoting IPTV service and interactivity improves customer’s service engagement.</td>
</tr>
<tr>
<td></td>
<td>Choi et al. (2010)</td>
<td>Perceived trialability/perceived usefulness/perceived ease of use/perceived enjoyment/prior experience/behavioral intention</td>
<td>Survey of two groups – the one group with IPTV experience and the other group with no previous IPTV experience</td>
<td>Perceived trialability is a function of perceived usefulness, which is on the other hand decided much by perceived ease of use. Perceptions of usefulness, ease of use, enjoyment are positively associated with behavioral intentions of IPTV service adoption.</td>
</tr>
<tr>
<td></td>
<td>Lee et al. (2012)</td>
<td>IPTV specific features/innovation diffusion/demographic statistics/social influence/personal innovativeness/adoption intention</td>
<td>Surveyed a group of people with no previous IPTV experience</td>
<td>Relative advantage, compatibility, trialability, content richness, economic value, personal innovation, social influence affect IPTV adoption intention. Also, service reputation, interactivity, content richness and economic value positively affect adoption intention through the relative advantage variable.</td>
</tr>
<tr>
<td></td>
<td>Pezzi (2010)</td>
<td>Willingness to pay/service awareness/value adding contents</td>
<td>Survey of satellite broadcasting, digital TV and IPTV user groups</td>
<td>Sports and movies are content types catering to higher willingness to pay for IPTV. Among various quality dimensions, screen quality and sound quality are found to be the most important. It was also learned that the male groups in their 20s and 30s have the highest chance of adopting IPTV service.</td>
</tr>
</tbody>
</table>

(continued)
<table>
<thead>
<tr>
<th>Type</th>
<th>Researcher</th>
<th>Key variables</th>
<th>Research method</th>
<th>Results/Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Weniger (2010)</td>
<td>Personal innovativeness/computer playfulness/perceived quality/cognitive absorption/perceived usefulness/perceived ease of use/perceived enjoyment/perceived price level/intention to use IPTV</td>
<td>Propose a research model based on literature survey</td>
<td>Perceived enjoyment and other factors included in the model can affect IPTV adoption, and there is a need to examine the correlation between the intention to adopt IPTV and its actual purchase behavior</td>
</tr>
<tr>
<td></td>
<td>Sawng et al. (2014a)</td>
<td>System quality/richness in convergence functions/economic benefit/innovativeness/usefulness perception/reuse intention</td>
<td>Survey of IPTV service users in Korea and Japan</td>
<td>Rich convergence functions, perceived economic benefit and innovativeness affect usefulness perception and reuse intention. The association between system quality and usefulness was significant only in the Japanese group When there is fusion between social network functions and IPTV, the chance of IPTV adoption may increase considerably</td>
</tr>
<tr>
<td></td>
<td>Schreiber et al. (2010)</td>
<td>Content recommendations/community awareness/community meta content/end-2-end communication/participatory IPTV/social applications</td>
<td>Designed IPTV contents and service scenarios, and conducted surveys against potential customers and professional groups in their adoption intentions</td>
<td>For IPTV non-adopters, trialability, innovativeness and perceived risks are associated with IPTV satisfaction. To IPTV adopters, complementarity and communication factors were significant in explaining user satisfaction</td>
</tr>
<tr>
<td></td>
<td>Motohashi et al. (2012)</td>
<td>Influence factors (adoption diffusion model)/influence factors (use diffusion model)/common factors/perceived ease of use/perceived usefulness/rate of use/variety of use/intention to subscribe/intention to re-use/satisfaction</td>
<td>Surveys were administered to two different groups of IPTV adopters and non-adopters</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lin et al. (2012)</td>
<td>Perceived value/perceived advantage/satisfaction</td>
<td>IPTV or MoD service users were surveyed</td>
<td>Customers' perceived net value of IPTV service drives service satisfaction and intention to continue its usage</td>
</tr>
</tbody>
</table>

(continued)
<table>
<thead>
<tr>
<th>Type</th>
<th>Researcher</th>
<th>Key variables</th>
<th>Research method</th>
<th>Results/Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blasco-Arcas</td>
<td><em>et al.</em> (2011)</td>
<td>Interactivity/personalization/perceived control/satisfaction</td>
<td>Surveyed college students who were competent in IT usage</td>
<td>The results indicate that interactivity and personalization capability of IPTV grow customers’ perceived control and satisfaction. Also, their synergy effects are stronger than their individual influences combined.</td>
</tr>
<tr>
<td>Jan <em>et al.</em></td>
<td>(2012)</td>
<td>System quality/information quality/service quality/video quality</td>
<td>Surveys were administered on regular TV viewers and IPTV subscribers</td>
<td>Surveys on both service provider and subscriber groups revealed discrepancies in 10 out of 24 service quality dimensions and they agreed on only 4 service quality dimensions, highlighting importance in reducing the perception gap between the two groups.</td>
</tr>
<tr>
<td>Nasir and</td>
<td>Khan (2014)</td>
<td>Quality of services/channel zapping time/repair packet loss/IPTV customer</td>
<td>IPTV professionals and customers were surveyed</td>
<td>Product experience and sophistication of technology are important variables in the diffusion of IPTV innovation. Also, functional similarity, complementarity and substitution effect influence customer satisfaction.</td>
</tr>
<tr>
<td>Sawng *et</td>
<td>al.* (2013)</td>
<td>Product experience/sophistication of technology/household innovativeness/</td>
<td>IPTV customers from Korea and Japan are surveyed</td>
<td>Predicted rapid progressing user experience including interactivity, customization, recommendation capacity and targeted commercials. This requires standardization of relevant technologies and resolution of security issues.</td>
</tr>
<tr>
<td>Service</td>
<td>prediction</td>
<td>Architectural design challenges/market trends</td>
<td>Qualitative study and predictions on IPTV technology standardization, market</td>
<td></td>
</tr>
<tr>
<td>Zeadally *et</td>
<td>al.* (2011)</td>
<td></td>
<td>trends, architectural design and system environment</td>
<td></td>
</tr>
</tbody>
</table>

(continued)
<table>
<thead>
<tr>
<th>Type</th>
<th>Researcher</th>
<th>Key variables</th>
<th>Research method</th>
<th>Results/Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contents</td>
<td>Bouwman et al. (2008)</td>
<td>Regulatory environment/industry structure/consumer attitudes</td>
<td>Development of service scenarios and analysis through case studies, literature review and interviews</td>
<td>Design of IPTV-based business models should be based on systematic analysis of external (environmental) factors and uncertainties</td>
</tr>
<tr>
<td>Contents</td>
<td>Lin et al. (2014)</td>
<td>Content characteristics/sensationalism/localism/interactivity</td>
<td>Classified IPTV providers in Singapore in terms of their service types and analyzed their characteristics</td>
<td>IPTV resorts to more sensationalism than ordinary TV channels do. Currently limited interactivity is available but this needs to be expanded further in the relationship between customers and contents; customers and the system; and customers and customers</td>
</tr>
<tr>
<td></td>
<td>Sawng et al. (2014b)</td>
<td>Total voice of customer/switching barriers/contents use pattern/paid contents consumption</td>
<td>Web log data of IPTV service customers in Korea are analyzed</td>
<td>VOC is positively associated with the increased sales of fee-based contents. Viewing hours and monthly subscriptions of contents are positively associated with IPTV provider’s service sales as well</td>
</tr>
</tbody>
</table>
be necessary to extend the scope of interactivity from the current “customer and contents” to the “customer and customer” level to sustain service growth and maintain healthy revenue streams (Lin et al., 2014; Schreiber et al., 2010).

2.2 Customer defection

Customers voluntarily or involuntarily drop current service usage and/or switch to competitor’s offering. Customer defection behaviors can manifest in different forms: some do not use available service for an extended period, some delay payment of service fees and some choose to drop service subscription altogether. Generally speaking, we can consider that customer churning results when a customer stops subscription and thus has no intention to continue service usage.

A service company has vested interests in learning about customers’ churning behaviors because keeping existing customers is financially and strategically much more beneficial than finding new customers (Hejazinia and Kazemi, 2014). Loyal customers can ensure stable revenue generation and become a source of revenue augmentation through cross-selling and up-selling. Reflecting on their importance, much research has been conducted to determine causes of customer churning behaviors and to improve their predictability from the perspective of customer relationship management grounded on such methodology as data mining and social science (e.g. customer survey) research.

Research on customer defection has been largely on two issues. The first is to understand its triggering forces for which hypothesized influence of antecedents on customer churning is investigated through customer data available from service providers or through self-report surveys (Ahn et al., 2006; Eshghi et al., 2006; Hejazinia and Kazemi, 2014; Kim and Yoon, 2004; Kisioglu and Topcu, 2011; Oghojafor et al., 2012; Portela and Menezes, 2010; Wong, 2011). The second approach is to develop prediction models of customer behaviors (Coussement and De Bock, 2013; Coussement et al., 2010; Glady et al., 2009; Gorgoglione and Panniello, 2011; Gürsoy, 2010; Hadden et al., 2005; Hou and Tang, 2010; Huang et al., 2010; Huang et al., 2012; Jahromi et al., 2014; Jamal and Bucklin, 2006; Lariviere and Van den Poel, 2004; Lin et al., 2011; Migueis et al., 2012; Neslin et al., 2006; Owczarczuk, 2010; Qi et al., 2009; Richter et al., 2010; Tsai and Chen, 2010; Tsai and Lu, 2009; Verbeke et al., 2011; 2014; Wang et al., 2009; Xia and Jin, 2008; Xiao et al., 2014; Xie et al., 2009; Yu et al., 2011; Zhang et al., 2012). They use various data mining techniques to compare predictive performance of models derived, to develop new prediction models or to compute the probability of customer defections through simulations.

Our study focuses on unravelling main causes of customer defection for which the impact of studied antecedent variables is analyzed based on real transactional customer data obtained from customers’ web logging and the service provider’s database. For the study, we consider that a customer has defected if he/she canceled IPTV service during a month-long period of monitoring at the time of the study. Current studies of IPTV that investigated customer churning are summarized in Table II.

In previous studies, various antecedents of consumer defections have been studied in the context of different service industries. The antecedents include such clients’ demographic factors as residential areas, income levels and ages (Ahn et al., 2006; Kim and Yoon, 2004; Kisioglu and Topcu, 2011; Oghojafor et al., 2012; Portela and Menezes, 2010; Wong, 2011). It has been frequently shown that higher levels of perceived service quality and satisfaction lead to lower chances of consumer churn (Ahn et al., 2006; Eshghi et al., 2006; Hejazinia and Kazemi, 2014). On the other hand, there has been an argument that, depending on the analytical approach and people sampled for research, consumer satisfaction may not be a reliable indicator of customer churning behaviors (Portela and Menezes, 2010).
<table>
<thead>
<tr>
<th>Studies</th>
<th>Key variables</th>
<th>Research method</th>
<th>Key findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ahn et al. (2006)</td>
<td>Customer dissatisfaction/switching costs/service usage/customer-related variables/customer status/customer churn</td>
<td>Logit regression based on service data from 5,789 customers of a telecom service provider</td>
<td>Call dropping, customer complaints, membership points, monthly fees and membership status affect customer churn. Also membership status mediated the influences of call dropping, membership points and monthly fees on customer churn.</td>
</tr>
<tr>
<td>Eshghi et al. (2006)</td>
<td>Perceived quality/customer expectations/perceived value/customer satisfaction/customer complaints/customer loyalty</td>
<td>Survey data gathered from 2,542 telecom service users and use of structural equation modeling</td>
<td>Customer dissatisfaction is a contributor of service switching and efforts are necessary to improve perceived service quality and service values to grow consumer satisfaction. Furthermore, it is important to have a communication strategy that forms more realistic consumer expectations from service providers.</td>
</tr>
<tr>
<td>Hejazinia and Kazemi (2014)</td>
<td>Switching cost/service price/quality/satisfaction/security concerns/competitors with superior technology/advertising/customer churn</td>
<td>Survey data from 415 customers of an Iranian telecom service provider. Data analysis based on such methods as t-test and Friedman test</td>
<td>Service quality, satisfaction, availability of superior competitors, switching cost and marketing exposure had positive influences on consumer defections. Service price and security concerns had little effect on the dependent variable.</td>
</tr>
<tr>
<td>Kim and Yoon (2004)</td>
<td>Call quality/billing/tariff level/value-added services/customer services/handset/brand image/age/sex/income/monthly payment/duration of subscription/duration of handset used/switching experience/loyalty/customer churn</td>
<td>Logit regression based on the survey data from 973 customers of a large mobile telecom service provider in Korea</td>
<td>Customers’ defection intention is affected by their service satisfaction. Also significant are variables of call quality, service cost, handset, satisfaction with brand image, income level and duration of service subscription. It revealed that income level and duration of handset use are positively associated with defection intention, but duration of service subscription had a negative relationship with switching intention.</td>
</tr>
<tr>
<td>Kisioglu and Topcu (2011)</td>
<td>Place of residence/age/average billing amount/trend in billing amount/average frequency of usage/average minutes of usage/churn</td>
<td>Service data of 2000 customers of a Turkish telecom service provider</td>
<td>Such variables as average minutes of usage, average billing amount and average frequency of usage were indicators of customer churn.</td>
</tr>
<tr>
<td>Studies</td>
<td>Key variables</td>
<td>Research method</td>
<td>Key findings</td>
</tr>
<tr>
<td>----------------------</td>
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</tr>
<tr>
<td>Oghojafor et al. (2012)</td>
<td>Marital status/age/occupational status/income/place of residence/educational level/gender/call expenses/advertising medium/No of mobile connections/type of service plan/service facility/customer churn</td>
<td>Survey of 800 customers of a Nigerian telecom service provider and data analysis based on multivariate analytical methods</td>
<td>There are higher chances of customers churn when call expenses are high; when service satisfaction is low; when there is lack of optimization in advertising medium; when there are better choices (i.e. service providers); and when the service plan is not adequately matched</td>
</tr>
<tr>
<td>Portela and Menezes (2010)</td>
<td>Gender/total dunning/overall revenues/debts/value of off-peak calls/telephone revenues/internet revenues/customer churn</td>
<td>Survey data gathering on 830 customers of a Portuguese telecom service provider</td>
<td>Study variables except usage, product features and contract types were weak indicators of customer intention to sustain service usage. Customer defection was not a function of satisfaction</td>
</tr>
<tr>
<td>Wong (2011)</td>
<td>Rate plan suitability/customer age/customer residing location/consumption of value added services/customer churn</td>
<td>Service data were gathered from 1,525 customers of a Canadian mobile service provider and analyzed with logit regression</td>
<td>55.4% of customers are shown weak in their rate plan suitability and their service defection was higher than those whose rate plan was optimized. The results underscore the importance of identifying suitable rate plan for each customer</td>
</tr>
</tbody>
</table>
As a strategic path to curtail customer defections, service providers may resort to communications in order for customers to form realistic service expectations (Eshghi et al., 2006). Also, network service providers need to manage customer satisfaction based on broad service elements, including QoS, terminals and brand images (Kim and Yoon, 2004). Besides, through systematic analysis of client data, optimization may be necessary on service pricing, payment arrangement and the level of commercialization (Wong, 2011; Oghojafor et al., 2012). Despite that many studies have been conducted on customer retention and churn, there is scant research on customer behaviors in the context of IT convergence service such as IPTV and, to the best of our knowledge, few empirical works of this type have been undertaken based on real customer data – rather than perception-driven surveys – gathered by a large telecommunications service company.

2.3 Voice of customer

In its narrow definition, VOC represents customers’ feedback about their experiences with and expectations for your products or services, heard through various internal and external communication channels. In a broader definition, VOC embraces a service provider’s attitude and volition to actively seek customer-related information in terms of consumer opinions, implicit consumer expectations, innate consumer values, transactional intentions and related behavioral patterns. Regardless of their narrow or broader definition, the objective to gather VOC is to offer improved customer service and satisfaction by curtailing consumer dissatisfaction and ultimately pursuing the state of zero complaint.

At a service firm, VOC should guide customer-oriented system optimization, planning and deployment of communication tools, development of core marketing strategy and management of marketing resources. Berry and Parasuraman (1997) emphasized importance of VOC in understanding consumer discontent and improving service quality. They underscored that current customers, competitors’ clients as prospective customers and service-provisioning employees are all VOC sources, and efforts be made to pay attention to VOC from each stakeholder’s perspective. That is, VOC may be highly valuable in deriving quality conditions of CRM expected from customers. It is therefore not difficult to expect that more effective service marketing becomes viable when communication strategies are tailored to groups with distinctively different VOC.

2.4 Switch barrier

Switch barriers are services or other factors that discourage customers from dropping current subscriptions to move to a competitor’s offer (Jackson, 1985; Jones et al., 2000). For service providers, customer switching has a considerable impact on market share and profitability, and they should find strategic solutions to raise switch barriers (Rust and Zahorik, 1993). When consumers’ intentions to sustain current service usage lead to reductions in their defections, this may strengthen their service loyalty in the long run, and subsequently, firms may be able to sell services at regular prices, positively contributing to their bottom line (Reichheld and Sasser, 1990). On the contrary, the attrition of loyal customers forces a firm to invest additionally to find new clients, costing the firm five times more than that of maintaining existing customers (Singh, 1990).

In Fornell’s (1992) study, the statistical association between the switch barrier variable and customer satisfaction was particularly strong. Jeong and Moon (2008), in their study of service switching and reuse intentions based on airline industry customers, showed that switching cost and the attractiveness of alternatives are key switch barriers. It was found that procedural, financial and relational aspects of switching costs discourage customers’ intention to change service providers, positively affecting continued usage of existing
service. Byun (2009) divided switch barriers into those of positive and negative groups, and found that positive barriers significantly affect customer loyalty and their retention.

It is also known that, when there are intensive market competition and diversification in personal needs, customers still drop existing providers despite the high switching cost. Not surprisingly, we are witnessing that, with growing trends for consumers to pursue richer and unique usage experience, more people are positively responding to services newly introduced to the marketplace rather than maintaining their loyalty to existing membership (Trijp et al., 1996). This development underscores that firms need to manage service switching barriers tailored to diversified customer needs and different customer characteristics, rather than trying to build and sustain the traditional, one-size-fits-all switch barriers (Menon and Kahn, 1995).

2.5 Study variables and research model
After reviewing characteristics of IPTV service and relevant existing literature, we examine the effects of IPTV’s switch barriers (i.e. service bundling, remaining contract months and membership points), degree of service usage measured through different options of content views, VOC and membership period variables on customer’s intention to continued IPTV usage. The study variables and their definitions are summarized in Table III.

<table>
<thead>
<tr>
<th>Variable Type</th>
<th>Variable categorization</th>
<th>Study variables included</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent Independent</td>
<td>Customer behaviors</td>
<td>Customer defection</td>
<td>Defected customer? (defect = 1, stay = 0)</td>
</tr>
<tr>
<td></td>
<td>Switch barriers</td>
<td>Service bundling</td>
<td>Bundled with other service? (bundled = 1, not bundled = 0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Remaining contract</td>
<td>Number of months remaining before the contract expires</td>
</tr>
<tr>
<td></td>
<td></td>
<td>months</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Membership points</td>
<td>Similar to cyber money, offered as an incentive tied to IPTV usage. Could be used just like cash to pay for other fee-based services</td>
</tr>
<tr>
<td></td>
<td>VOC (voice of customer)</td>
<td>Total VOC</td>
<td>Total number of VOC (e.g. complaint) filed with the service center</td>
</tr>
<tr>
<td>Membership period</td>
<td>Membership years</td>
<td></td>
<td>Number of years as an IPTV customer</td>
</tr>
<tr>
<td>Degree of content usage</td>
<td>Channel views</td>
<td></td>
<td>Number of channel views during one month of web logging. Views of traditional regular channels are logged</td>
</tr>
<tr>
<td></td>
<td>VOD views</td>
<td></td>
<td>Number of VOD views during the month of web logging. Includes both free and fee-based contents</td>
</tr>
<tr>
<td></td>
<td>TVOD views</td>
<td></td>
<td>Number of terrestrial broadcasting VOD views during the month of web logging. TVOD provides recorded rerun of popular programs shown in regular channels. This service is fee-based</td>
</tr>
<tr>
<td></td>
<td>PPV</td>
<td></td>
<td>Number of PPV during the month of web logging. This service is fee-based</td>
</tr>
<tr>
<td>Monthly subscriptions</td>
<td></td>
<td></td>
<td>Number of topic channels purchased on monthly basis (e.g. movie, online game, children)</td>
</tr>
</tbody>
</table>

Table III. Study variables
Incorporating the study variables, the following research model in Figure 1 is proposed based on the previous discussions of relevant theories and findings from existing studies.

3. Research method
3.1 Data gathering and analysis
For empirical analysis, we gathered IPTV service users’ web log, VOC records and demographic information from the database of a large IPTV service provider in Korea that had 6.7 million IPTV subscribers as of April 2016 (Korea IPTV Broadcasting Association, 2016). The sampling pool of the study included all customers who maintained their IPTV subscription for four years from July 2010 through July 2014. Out of the sampling pool, a sample of 5,000 was randomly chosen based on the stratified sampling of defector and non-defector groups. More specifically, the sample included 2,500 customers who dropped the IPTV service during the next month period (8.1-8.31, 2014) and 2,500 customers who stayed with the service during the same month period (8.1-8.31, 2014). From the initial sample of 5,000, those with missing data values and having data quality problems are dropped from further consideration. This filtering process left 3,906 people – 2,008 defectors and 1,898 non-defectors – which represented 0.06 per cent of the population. The customer data (e.g. web log) of the two groups gathered by the company during the six-month period from February 2014 through July 2014 are used for this study.

We used Strata v11.2 for statistical analysis of the data. Descriptive statistics of customer demographics are presented first in terms of IPTV bundling, membership join year, gender and age group. Then correlation coefficients between study variables are reviewed to have exploratory understanding of their relationships. Subsequently, the defecation and non-defecation groups are compared in their statistical differences in the dimensions of switch barriers, VOC, membership period and content usage. Then, using the double-log curvilinear regression, the associations between the content usage variables (e.g. channel views, VOD views) and their antecedents (i.e. switch barriers, VOC and membership years) are examined. Finally, a logit regression was applied to model the effects the independent variables (i.e. switch barriers, VOD, membership period and content usage) have on customer churn.

Figure 1.
Research model
3.2 Analytical model and hypotheses

3.2.1 Degree of content usage (first analysis). Generally, higher switch barriers can increase profitability because of the close relationship between customers and service providers (Rust and Zahorik, 1993). However, in the intensifying competition society, it is hard to determine that no churn rate is the higher utilization of services. In recent years, it has been necessary to analyze the content consumption behavior of individual customers in relation to the switch barriers, as customers instantly react to new and unique products and services. Therefore, the following hypotheses are set up between the switch barrier and contents consumption behavior:

\[ H1. \text{ Service bundling is significantly related to a degree of content usage.} \]
\[ H2. \text{ Remaining contract months are significantly related to a degree of content usage.} \]
\[ H3. \text{ Membership points are significantly related to a degree of content usage.} \]

In addition, VOC can also be interpreted as a customer loyalty in that it is a positive sign to service provider (Fornell, 1992). As VOC is an important source of information for improving service quality (Berry and Parasuraman, 1997), analyzing the contents consumption behavior of customers who are actively giving information can provide important implications for future service improvement. Therefore, the following hypotheses are set about the relationship between VOC and subscription period and content consumption behavior:

\[ H4. \text{ Total VOC is significantly related to a degree of content usage.} \]
\[ H5. \text{ Membership years are significantly related to a degree of content usage.} \]

Following statistical model and research hypotheses are proposed with regard to the relationship between the degree of content usage and selected independent variables. For the hypothesis testing, a curvilinear regression model (double-log function) is used:

\[
\ln (\text{degree of contents usage}) = \beta_0 + \beta_1 \ln (\text{service bundling}) + \beta_2 \ln (\text{remaining contract months}) + \beta_3 \ln (\text{membership points}) + \beta_4 \ln (\text{total VOC}) + \beta_5 \ln (\text{membership years}) + \varepsilon:
\]

\[ H1 \quad H_0: \beta_1 = 0, \quad H_1: \beta_1 \neq 0 \]
\[ H2 \quad H_0: \beta_2 = 0, \quad H_1: \beta_2 \neq 0 \]
\[ H3 \quad H_0: \beta_3 = 0, \quad H_1: \beta_3 \neq 0 \]
\[ H4 \quad H_0: \beta_4 = 0, \quad H_1: \beta_4 \neq 0 \]
\[ H5 \quad H_0: \beta_5 = 0, \quad H_1: \beta_5 \neq 0 \]

3.2.2 Customer churning out (second analysis). Switch barriers, VOCs and subscription terms of IPTV services can affect not only content consumption behavior but also customer churn rate. Customer churn is driven by multidimensional influences such as service utilization levels, transaction duration, service quality and satisfaction. (Ahn et al., 2006; Eshghi et al., 2006; Hejazinia and Kazemi, 2014). Ultimately, it is necessary to analyze the relationship between IPTV service providers’ switch barriers and VOCs, as they are aimed at preventing customer churn and establishing long-term relationships. Therefore, the following hypotheses were established with regard to the switch barrier, VOC and subscription period:
Service bundling is significantly related to a service defection.

Remaining contract months are significantly related to a service defection.

Membership points are significantly related to a service defection.

Total VOC is significantly related to a service defection.

Membership years are significantly related to a service defection.

Channel views are significantly related to a service defection.

VOD views are significantly related to a service defection.

TVOD views are significantly related to a service defection.

Pay per views (PPV) are significantly related to a service defection.

Monthly subscriptions are significantly related to a service defection.

Contents consumption behavior predicts the possibility of customer churn in that it is an indirect indicator of customer’s satisfaction with service and continuous use. In fact, in the previous study, it was confirmed that the frequency of using services was a precursor of customer churn (Kisioglu and Topcu, 2011). Based on this study, the following hypotheses about contents consumption behavior and customer churn were established:

Channel views are significantly related to a service defection.

VOD views are significantly related to a service defection.

TVOD views are significantly related to a service defection.

Pay per views (PPV) are significantly related to a service defection.

Monthly subscriptions are significantly related to a service defection.

Grounded on Fornell’s (1992) prediction model, the following logit model is constructed to explain the relationship between customer defection and antecedent variables, including switching barriers of IPTV service, and hypotheses are proposed in terms of their expected association relationship.

\[
\log \left( \frac{P}{1-P} \right) = \beta_0 + \beta_1 \text{ (service bundling)} + \beta_2 \text{ (remaining contract months)} + \beta_3 \text{ (membership points)} + \beta_4 \text{ (total VOC)} + \beta_5 \text{ (membership years)} + \beta_6 \text{ (channel views)} + \beta_7 \text{ (VOD views)} + \beta_8 \text{ (TVOD views)} + \beta_9 \text{ (PPV)} + \beta_{10} \text{ (monthly prescriptions)} + \epsilon
\]

where \( P \) = a customer’s defection probability:

\[H6 \quad H_0 : \beta_1 = 0, \quad H_1 : \beta_1 \neq 0\]

\[H7 \quad H_0 : \beta_2 = 0, \quad H_1 : \beta_2 \neq 0\]

\[H8 \quad H_0 : \beta_3 = 0, \quad H_1 : \beta_3 \neq 0\]

\[H9 \quad H_0 : \beta_4 = 0, \quad H_1 : \beta_4 \neq 0\]

\[H10 \quad H_0 : \beta_5 = 0, \quad H_1 : \beta_5 \neq 0\]

\[H11 \quad H_0 : \beta_6 = 0, \quad H_1 : \beta_6 \neq 0\]

\[H12 \quad H_0 : \beta_7 = 0, \quad H_1 : \beta_7 \neq 0\]

\[H13 \quad H_0 : \beta_8 = 0, \quad H_1 : \beta_8 \neq 0\]

\[H14 \quad H_0 : \beta_9 = 0, \quad H_1 : \beta_9 \neq 0\]

\[H15 \quad H_0 : \beta_{10} = 0, \quad H_1 : \beta_{10} \neq 0\]
4. Results and interpretations

4.1 Demographics
The demographic information of customers in the sample is summarized in Table IV. Overall, two distinct patterns emerge. First, there is a clear indication that customers who opt for service bundling which combines IPTV with other services (e.g. VoIP and mobile cellular phone communications) had a much lower chance of abandoning it than those who subscribe it on a single-service basis. Another noticeable revelation is related to the distinct behavioral patterns of different age groups in IPTV service use. The comparison of defector versus non-defector groups in terms of their relative percentages indicates that there is a higher chance of dropping IPTV service among older age groups. That is, the percentage of the IPTV defection rate was consistently lower than the non-defection rate among the age groups of 40s or younger, but this reverses in the age group of 50s and 60s.

4.2 Correlation coefficients
To explore association relationships between study variables, their correlations are reviewed as in Table V. Strong positive correlations are observed between total VOC filing and monthly service subscription (0.74); between channel views and the three variables of VOD (0.59), TVOD (0.52) and PPV (0.56) views; and between VOD and TVOD (0.94).

4.3 Two-sample comparison
The two groups (i.e. defection and non-defection groups) are compared in terms of the study variables and the results are summarized in Table VI. The two-sample $t$-tests reveal that

<table>
<thead>
<tr>
<th>Variables</th>
<th>Total ($n = 3,906$)</th>
<th>Defector group ($n = 2,008$)</th>
<th>Non-defector group ($n = 1,898$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bundling with other services?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bundling</td>
<td>1,559 (39.9%)</td>
<td>1 (0.1%)</td>
<td>1,558 (82.1%)</td>
</tr>
<tr>
<td>No bundling</td>
<td>2,347 (60.1%)</td>
<td>2,007 (99.9%)</td>
<td>340 (17.9%)</td>
</tr>
<tr>
<td>Membership join year</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>92 (2.4%)</td>
<td>43 (2.1%)</td>
<td>49 (2.6%)</td>
</tr>
<tr>
<td>2011</td>
<td>754 (19.3%)</td>
<td>307 (15.3%)</td>
<td>447 (23.6%)</td>
</tr>
<tr>
<td>2012</td>
<td>2,068 (52.9%)</td>
<td>1,153 (57.4%)</td>
<td>915 (48.2%)</td>
</tr>
<tr>
<td>2013</td>
<td>688 (17.6%)</td>
<td>359 (17.9%)</td>
<td>329 (17.3%)</td>
</tr>
<tr>
<td>2014</td>
<td>304 (7.8%)</td>
<td>146 (7.3%)</td>
<td>158 (8.3%)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>1,595 (40.8%)</td>
<td>759 (40.0%)</td>
<td>836 (41.6%)</td>
</tr>
<tr>
<td>Female</td>
<td>2,311 (59.2%)</td>
<td>1,139 (60.0%)</td>
<td>1,172 (58.4%)</td>
</tr>
<tr>
<td>Age group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 20</td>
<td>63 (1.6%)</td>
<td>33 (1.7%)</td>
<td>30 (1.5%)</td>
</tr>
<tr>
<td>20's</td>
<td>325 (8.3%)</td>
<td>128 (6.7%)</td>
<td>197 (9.8%)</td>
</tr>
<tr>
<td>30's</td>
<td>1,130 (28.9%)</td>
<td>513 (27.0%)</td>
<td>617 (30.7%)</td>
</tr>
<tr>
<td>40's</td>
<td>1,219 (31.2%)</td>
<td>592 (31.2%)</td>
<td>627 (31.2%)</td>
</tr>
<tr>
<td>50's</td>
<td>803 (20.6%)</td>
<td>438 (23.1%)</td>
<td>365 (18.2%)</td>
</tr>
<tr>
<td>60&lt;</td>
<td>366 (9.4%)</td>
<td>194 (10.2%)</td>
<td>172 (8.6%)</td>
</tr>
<tr>
<td>Total</td>
<td>3,906 (100.0%)</td>
<td>1,559 (100.0%)</td>
<td>2,347 (100.0%)</td>
</tr>
</tbody>
</table>

Table IV. Summary of sample data

Understanding IPTV churning behaviors
customers of the defection group had lower membership points, higher VOC filing and significantly lower content usage in terms of channel views, VOD views, TVOD views and PPV.

### 4.4 Double-log and logistic regressions

To test \( H1 \) through \( H5 \), the double-log regression method was used in which variables of contents usage become the dependent variables (Table VII). Among included independent variables, service bundling and total VOC had a positive association with all variables of contents usage. On the other hand, remaining contract months was negatively associated with channel views, VOD views and PPV. Membership points had a positive association with contents usage variables, except the monthly service variable, and overall, there is a strong negative relationship between membership years and the contents usage level.

To test \( H6 \) through \( H15 \), a logistic regression was performed in which customer defection becomes the dependent variable. As shown in Table VIII, variables relevant to service bundling and frequency of PPV are negatively associated with customer defection, whereas Total VOC and monthly subscription have positive associations with customer defection.
Building on the analysis of the logistic regression, further analysis is performed by constructing prediction models on how the two significant variables – different levels of Total VOC (as a positive indicator) and PPV (as a negative indicator) – affect customers’ defection behaviors (Figure 2). In the case of VOC, as a customer’s VOC increases, the chance of customer churn increases as well regardless of subscribing bundled or unbundled service. However, bundled service subscribers have a lower defection rate than single-service subscribers even with higher VOC. Also, it is noted that single-service subscriber’s defection grows fast in the early stage of VOC and then gradually stabilized. Whereas, bundled service subscribers display an opposite behavioral pattern in which the customer defection rate grows faster with higher VOC simulation. It also shows that as PPV purchase increases, customer defection drops. Single-service subscriber’s defection dropped a lot faster than that of bundled service subscribers when the former group’s PPV is increased (Table IX).
5. Discussions and conclusion

5.1 Discussions

Existing studies of IPTV service investigated varied research topics relevant to prediction of service adoption and adoption intention, repurchase and service continuance, service satisfaction and loyalty. Especially, much attention has been paid to the explanation of customer satisfaction, loyalty, repurchase and service continuance. Despite the research volume, to the best of our knowledge, very few IPTV studies (or even IT convergence research) are based on real customer input (i.e. web log) and transactional data. From that perspective, our work that took advantage of actual service data that provide detailed information of customer behaviors has an important contribution to the research community. Implications of our research findings can be summarized.

First, switching barriers, VOC and subscription period have direct associations with the degree of IPTV usage. Among switching barriers considered, the variable of “bundling with other services” was especially significant in explaining IPTV usage. This becomes a clear indication that when the IPTV service is bundled with other wired and/or wireless services, including high-speed internet access, VoIP and mobile communications, this becomes a more effective and sustainable business model. Also, the analysis indicates that customers with high VOC frequency have higher content usage, confirming that higher engagement of customers

![Figure 2. VOC/PPV and customer defection](image)

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Path</th>
<th>Statistical results</th>
<th>Test results</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>Service bundling → Degree of contents usage</td>
<td>$\beta_1 &gt; 0$</td>
<td>Supported</td>
</tr>
<tr>
<td>H2</td>
<td>Remaining contract months → Degree of contents usage</td>
<td>$\beta_2 &gt; 0$</td>
<td>Supported</td>
</tr>
<tr>
<td>H3</td>
<td>Membership points → Degree of contents usage</td>
<td>$\beta_3 &gt; 0$</td>
<td>Supported</td>
</tr>
<tr>
<td>H4</td>
<td>Total VOC → Degree of contents usage</td>
<td>$\beta_4 &gt; 0$</td>
<td>Supported</td>
</tr>
<tr>
<td>H5</td>
<td>Membership years → Degree of contents usage</td>
<td>$\beta_5 &gt; 0$</td>
<td>Supported</td>
</tr>
<tr>
<td>H6</td>
<td>Service bundling → Customer defection</td>
<td>$\beta_6 &lt; 0$</td>
<td>Supported</td>
</tr>
<tr>
<td>H7</td>
<td>Remaining contract months → Customer defection</td>
<td>$\beta_7 = 0$</td>
<td>Not supported</td>
</tr>
<tr>
<td>H8</td>
<td>Membership points → Customer defection</td>
<td>$\beta_8 = 0$</td>
<td>Not supported</td>
</tr>
<tr>
<td>H9</td>
<td>Total VOC → Customer defection</td>
<td>$\beta_9 &lt; 0$</td>
<td>Supported</td>
</tr>
<tr>
<td>H10</td>
<td>Membership years → Customer defection</td>
<td>$\beta_{10} &lt; 0$</td>
<td>Supported</td>
</tr>
<tr>
<td>H11</td>
<td>Channel views → Customer defection</td>
<td>$\beta_{11} = 0$</td>
<td>Not supported</td>
</tr>
<tr>
<td>H12</td>
<td>VOD views → Customer defection</td>
<td>$\beta_{12} = 0$</td>
<td>Not supported</td>
</tr>
<tr>
<td>H13</td>
<td>TVOD views → Customer defection</td>
<td>$\beta_{13} = 0$</td>
<td>Not supported</td>
</tr>
<tr>
<td>H14</td>
<td>PPV → Customer defection</td>
<td>$\beta_{14} &lt; 0$</td>
<td>Supported</td>
</tr>
<tr>
<td>H15</td>
<td>Monthly subscriptions → Customer defection</td>
<td>$\beta_{15} &lt; 0$</td>
<td>Supported</td>
</tr>
</tbody>
</table>

Table IX. Results of hypothesis testing

---
with the service firm leads to higher service usage intention and service purchase – highlighting importance of target marketing in designing marketing strategy. Meanwhile, the number of subscription years had a negative association with IPTV usage, which may imply that with longer service use, customers reach a sort of service plateau. This may indicate importance of introducing periodical promotions to the customer group based on new contents.

Second, it is shown that switch barriers, VOC and subscription period are partly associated with the defection of IPTV customers. Bundling was effective in discouraging service switching. Meanwhile, high VOC frequency was associated with higher chance of customer defection. The patterns in Figure 2 seem to imply that a certain level of VOC is a healthy expression relevant to service usage and purchase intention, but excessive occurrence of VOC may be a precursor of customer discontent and subsequent defection. Additional research is necessary to understand the VOC’s threshold value that becomes an inflection point of service dropping.

Third, it was found that PPV and monthly subscriptions showed positive and negative associations, respectively, with customer churning. This seems to imply that customers who prefer certain content genres have a stronger incentive to maintain their consumptions, but those who access many different content types by paying fixed monthly fees may opt to the service that offers more choices and thus could be more easily swayed by alternatives from competitors.

5.2 Limitations and research opportunities
This study has several limitations. First, although our analysis is based on real transactional records (i.e. web log and other customer data) of an IPTV service provider, limited availability of secondary data in terms of customer satisfaction, intention to continue service, customer loyalty and switching intention kept us from pursuing more in-depth study. Second, in analyzing VOC, our variable represented a simple counting of each person’s VOC filing. Further analysis can be performed by examining VOC texts and categorizing the patterns to better explain customer churning behaviors. Third, although there has been scant research on customer defections based on real service data, we acknowledge weaknesses in operationalizing study variables and deriving hypotheses grounded on solid theoretical basis. Our research can be expanded into many different research directions. For example, future studies of IT convergence service (not just IPTV) can design assessment methods of customer attitudes based on web logs and databases, develop typology of VOC inputs and apply them to the development of analytical and predictive models relevant to the performance dimensions of customer service, including customer churning, loyalty and service continuation.

References


Corresponding author
Sun-Young Park can be contacted at: sypark@konkuk.ac.kr

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The effects of emotional labor on work engagement and boundary spanner creativity

Jaewon Yoo and Jicheol Jeong
Soongsil University, Seoul, South Korea

Abstract
Purpose – This paper aims to examine the effect of employees’ emotional labor on work engagement and boundary-spanner creativity based on the job demands-resources model from the perspective of salespeople.

Design/methodology/approach – To analyze the data, a confirmatory factor analysis and structural equation modeling procedure using LISREL 8.5 were used. Next, the conditional process modeling was fitted to test the moderated mediation hypotheses.

Findings – The analysis results showed that deep acting has a positive effect on work engagement, whereas surface acting has a negative effect, indicating that work engagement of sales representatives is differently related to each factor of emotional labor. Second, work engagement of salespeople has a positive effect on boundary spanner creativity. Next, entrepreneurship has a moderate effect in the relationship between emotional labor and work engagement with customer stewardship and has a positive moderating effect in the relationship between work engagement and boundary spanner creativity.

Practical implications – Considering the positive effect of boundary spanner creativity on work engagement, it is important to maintain interaction with customers, including adaptive behaviors and customer orientation, as customers’ demand increases. The individual competence and capability of salespeople such as entrepreneurship are directly related to interaction with customers, so when the right strategy is defined for each type of entrepreneurship of salespeople, it will create a positive corporate culture and lead to performance improvement.

Originality/value – Compared with most studies, more direct factors of emotional labor were assessed to detect positive effects in this study. More specifically, when salespeople were forced to fake their feelings, they were more likely to recognize stress or burnout due to emotional dissonance between what they really felt and what they had to express to comply with organizational regulations.

Keywords Emotional labor, Entrepreneurship, Work engagement, Boundary spanner creativity, Customer stewardship

1. Introduction
Emotional labor is the process of regulating both feeling and expression for organizational goals (Grandey, 2000). Grove and Fisk (1989) suggest that emotional labor is a type of impression management by which an individual attempts to direct his/her behavior to enhance social perception or foster a certain interpersonal desired climate (Johnson, 2004).
Emotional labor has three features. First, it is generated from face-to-face contact and voice interaction with customers. Second, emotional expression affects the emotion, attitude and behaviors of others. Third, emotions should be expressed in emotional-display rules (Hochschild, 1983). As the number of salespeople increases and competition intensifies, they sometimes have to fake emotions that are different from their actual feelings; recently, the distress of emotional labor has become a social. Even when they are faced with derogatory and inhumane treatment, they still have to show customer-oriented kind responses and behaviors that comply with strict corporate and organizational rules; as such, emotional labor workers suffer from severe stress and psychological anxiety, which leads to an increasing rate of defection, with growing dissatisfaction and declining productivity. Moreover, most emotional laborers workers are temporary workers, and some work in indirect employment schemes, such as dispatching or subcontracting. Currently, under the pressure of cost reduction and streamlining resource management, companies are beginning to turn to and expand through outsourcing. With organizational changes from continuous restructuring and concerns over the nature and existence of their jobs, emotional labor workers are suffering from job insecurity.

A salesperson is an employee whose purpose is to build and develop customer relationships through direct interaction with customers, representing the company, and who plays the key role of managing and maintaining customer relationships, representing the company (Miao and Evans, 2013). The company’s role to protect the emotions of emotional labor workers, especially salespeople, is a critical factor in organizational performance. The management of the emotional exhaustion of salespeople should be interpreted as an investment for the sustainable performance of companies rather than as a cost to the corporation, as salespeople are agents who build relations with customers, representing the company and ultimately improving business performance. Previous studies in the same context have seen salespeople as boundary spanners to affect and build customer relationships, representing companies (Bradford and Weitz, 2009).

However, interactions with customers inevitably and emotionally affect salespeople for various reasons, which in turn affects salespeople’s defection rate and performance (Zablah et al., 2012). This leads to cost increases at companies, justifying the need for corporations to manage the emotional aspects of salespeople’s interactions with customers. However, despite these insights, most existing studies on salespeople have focused on how to manage and control salespeople at the organizational level to find the key to improving sales performance (Piercy et al., 2006). In fact, frontline employees do not see interaction with customers as pleasant work; rather, they associate it with negative feelings and dissatisfaction, and sometimes, it even causes emotional stress (Dormann and Zapf, 2004). Although most companies realize the importance of customer complaints and establishing measures to handle these complaints, they do not pay much attention to employees’ negative feelings and work stress caused by customer behaviors. Moreover, the moment of truth takes place for customers to define and assess service quality at the contact point (Norman, 1984). It is up to employees to decide the level of service quality, so if the stress generated from customer complaints is not properly relieved, it will lead to changes in employees’ behaviors and emotions (Bowen and Schneider, 1985; Hochschild, 1983). Thus, reviewing and properly managing employees’ emotions is highly important. In fact, managing the way salespeople express their emotions is a key factor in customers’ evaluation of a company and in an organization’s profits. Salespeople are required to express their emotions in a controlled and standardized manner (Wharton, 1993). Thus, even when they experience negative feelings due to customers’ behaviors, they often have to hide their feelings and fake positive responses. This often leads to emotional dissonance between what salespeople
actually feel and what they express; when they handle customer complaints frequently, their emotional resources are generally depleted. These emotional responses affect job satisfaction (Grandey, 2000) and have a negative impact on employees' physical health (Hochschild, 1983). To improve corporate performance and increase corporation members' satisfaction, it is important to address such emotional exhaustion. Additionally, although organizations strengthen their management and supervision of employees with corporate regulation, they tend to see employees' stress and feeling as a personal issue. In this context, it is meaningful to shed light on the causes of deep and surface acting in frontline employees' individual experiences in the process of conducting emotional labor, selling a product or service. Although, previous studies have examined the types of emotional labor, empirical studies on additional moderating factors related to types of emotional labor have not been sufficiently performed.

Thus, this study was designed to define the features of emotional labor with customers based on findings from previous studies and categorize factors of emotional labor into deep and surface acting to observe how they are related to work engagement and boundary spanner creativity and examine the moderating effect of employees' customer stewardship and entrepreneurship from salespeople's perspectives. Although researches on the employee's emotional labor may not be limited, the interplay of both personal characteristics of sales employees with their emotional labor is not well understood. A primary contribution of the research relates to strengthening our understanding of the formation and influence of a frontline employee's personal factor such as customer stewardship and entrepreneurship in the emotionally drained situation.

2. Literature review and hypotheses

2.1 Emotional labor

The first study on emotional labor that defined emotion as one of the factors of labor was by Hochschild (1983), and since then, many following studies have been conducted. The studies on emotional labor have looked into the sub factors (Hochschild, 1983; Adelmann, 1989), precedents and results of emotional labor (Ashforth and Humphrey, 1995; Morris and Feldman, 1996) and how to develop tools to assess emotional labor (Davies, 2002; Kruml and Geddes, 2000; Morris and Feldman, 1996), but there has been no general consensus on basic factors or universal standards on emotional labor. Even among scholars, definitions of emotional labor vary. Although Hochschild (1983) defined it as a way of managing emotions to make facial expressions or gestures, Ashforth and Humphrey (1995) saw it as a behavior of expressing socially required emotion during service transactions, and Morris and Feldman (1996) defined it as emotional effort, plan and control that are seen as being desirable in an organization. Meanwhile, Pizam (2008) said it is a behavior to initiate or repress one's emotion to please others, and Grandey (2000) saw it as a process of controlling one's emotions in performing job responsibilities. All of these definitions of emotional labor vary among scholars, but one thing they have in common is that emotional expression is controlled in the field of service work. Additionally, employees conducting emotional labor make efforts consciously or unconsciously to minimize stress when they choose to perform emotional labor, and in the process, they choose between deep or surface acting as a strategy to perform emotional labor (Hochschild, 1983).

Most emotional labor conceptualizations suggest that to display appropriate emotions at work, individuals must sometimes hide or fake felt emotions (surface acting) or try to experience the desired emotion (deep acting). In deep acting, employees endeavor to express authentic emotions, and though not every attempt succeeds, emotions expressed as a result of deep acting are more likely to be authentic than those expressed through surface acting,
which occurs when employees only change their outward emotional display without
genuinely altering how they actually feel (Yoo, 2016). Brotheridge and Grandey (2002)
categorized emotional labor into job-related and employee-related factors. Job-related
emotional labor was assessed based on frequency, period and level of diversity, whereas
employee-related emotional labor was defined as deep or surface acting. Finally, Kruml and
Geddes (2000) defined emotional labor with the two factors of genuine acting and emotional
dissonance. Meanwhile, factors related to employees can be seen in the theoretical
framework or conceptual factors of behaviors that Hochschild (1983) defined.

Based on these definitions, researchers decided that assessing emotional labor based on
deep or surface acting would be most suitable for the purpose and objectives of the study
and thus categorized emotional labor into deep or surface acting during the course of the
research. Surface acting means expressing emotions to comply with rules and regulations
only on the surface. In other words, to create emotional expressions that are in compliance
with organizational regulations, employees display disingenuous emotions with tone of
voice, facial expressions and gestures to make their emotions look genuine. To make sure
their emotions and attitudes seemingly comply with rules and regulations, they control their
behaviors, which means they fake emotions to make them look genuine, but they are not so.
Brotheridge and Grandey (2002) said that members corrected and controlled emotional
expression in the execution of surface acting. Deep acting means members make efforts to
actually feel the emotion internally. In pursuing organizational goals, members manage to
actually feel the emotions required as social norms or organizational requirements.

2.2 Impact of emotional labor on work
In many studies, deep and surface acting show conflicting results. Surface acting is an act of
controlling emotional expression only on the surface, and even when emotional labor
workers feel negative emotions, they fake or hide their feelings and pretend they feel
positive emotions. In surface acting, members of the organization express feeling reflectively
and mechanically without making efforts to align their actual feelings with the requirements
of the organization (Grandey, 2000). Thus, surface acting is a passive attitude toward
emotions, controlling emotional expression only on the surface but not internally (Scott and
Barnes, 2011). Surface acting leads to negative results like work stress and emotional
dissonance (Hochschild, 1983), and employees performing surface acting are deprived of
their human nature and tend to show high rates of burnout and defection (Brotheridge and
Lee, 2002; Grandey, 2000). In other words, the negative results may lead to lower service
quality and corporate image impairment, not just at an individual level but at the
organizational level as well. In contrast, deep acting means making additional efforts to
control internal emotion to comply with rules or regulation of the organization and indicates
more active engagement in emotional control than surface acting (Hochschild, 1983;
Grandey, 2000). In other words, instead of creating fake emotions, they express the feelings
they actually feel, and more specifically, they try to remind themselves of past experiences,
thoughts and images associated with that feeling (Brotheridge and Lee, 2002). Grandey
(2002) suggested a static relationship between deep acting and emotional burnout in a study
but did not develop meaningful study results, and no other study proves that deep acting
fuels emotional burnout (Brotheridge and Grandey, 2002; Schaufeli et al., 2002). Thus,
surface and deep acting should be explained with emotion regulation theory, indicating that
emotions are generated consistently, following the emotional process of individual members
in organizations (emotion regulation theory) (Brotheridge and Grandey, 2002). Based on
these theories, the following hypotheses were defined:
2.3 Moderating effect of customer stewardship

In domestic studies, customer stewardship is explained using stewardship theory. According to agent theory, owners are required to provide more incentives to agents to prevent moral hazard in information asymmetry. However, a results-oriented incentive scheme is not the best or only option for information symmetry (Levinthal, 1988).

Stewardship theory, emerging as an alternative to agent theory, was developed to provide better motivation and change the relations between owner and agent from information asymmetry into information symmetry. In contrast to organizational economics, which emphasizes a joint and organization-friendly contract, this approach analyzes behavior and relation with contractual parties (Van Slyke, 2007). In contrast to agent theory, this approach places a higher value on alignment with the goals of the owners rather than pursuing the agent’s own goals (Davis et al., 1997a, 1997b). In other words, a steward is different from an agent in agent theory in that the steward recognizes the successful contract and performance of the organization (community) as his/her own performance or success, makes decision for the sake of the owner and does not expect a financial incentive for individual performance (Davis et al., 1997a, 1997b).

Additionally, a steward is motivated with internal rewards like trust, honor, mutual benefits, discretion, autonomy, job satisfaction, stability and commitment. In stewardship, the owner resolves problems, shares information and makes decision together with the steward and conducts managerial activities based on collective interest rather than individual interest with an understanding of the steward’s needs (Van Slyke, 2007). In the stewardship model, the earlier stages of the contract have a higher cost of transaction than principal-agent relations. However, as the owner builds a relationship of trust with the steward and a contractual management scheme to align mutual goals in the long term, and as the contractual parties come to understand the motivation, signals and behaviors of each other, eventually, the cost of the transaction will decline over time. In other words, as the goals of the contractual parties become aligned and trust is building, the cost of holding each other accountable will decrease. At that time, the goals of the contractual parties will be well aligned with trust and honor, in mutual rather than unilateral relations, and the steward will consequently receive rewards. The steward also places more value on cooperation even when his/her goal is not perfectly aligned with the goal of the owner due to the owner’s self-interest or negligence because the steward sees the execution of contractual duties to be more beneficial than seeking individual benefits (Davis et al., 1997a, 1997b). Accordingly, using stewardship theory to manage relationships between contractual parties based on shared goals may not be suitable for market production or other policy areas but seems to be more suitable for social service areas (Van Slyke, 2007). According to Davis et al., (1997a, 1997b), management develops stewardship with agents, leveraging psychological factors like power, motivation and identification and circumstantial factors like culture and business management philosophy. Thus, in this study, salespeople’ commitment to customers was interpreted as stewardship, and it was assumed that for salespeople, individual sales performance was the same as corporate performance and that their commitment to customers associated with performance can be explained with stewardship theory. Additionally, participants of the study work at a membership-based sales company, not in general sales service, so they can be considered individual agents of the business for which individual performance creates incentives and profits. The owner-manager of
business is emotionally more tied to the company than professional management (Gomez-Mejia et al., 2003) and identifies themselves with the company (Kets de Vries, 1993); among circumstantial factors, they put more value on long-term factors, like corporate substantiality, rather than short-term profits (James, 1999; Kets de Vries, 1993). Accordingly, in this study, it was assumed that customer stewardship would have a meaningful moderating effect on salespeople, so the following hypotheses were established:

\[ H_{2a} \] Salespeople’s customer stewardship positively moderates the effect of deep acting on work engagement.

\[ H_{2b} \] Salespeople’s customer stewardship negatively moderates the effect of surface acting on work engagement.

2.4 Effect of work engagement on boundary spanner creativity

The job demands-resources model is a theory to define how the elements of job demand and resources affect performance through emotional aspects of organizational members such as work engagement or burnout (Schaufeli and Bakker, 2004). Schaufeli et al. (2009) attempted to explain members’ work engagement based on the job demands-resources model in a comprehensive way, and the importance of work engagement was emphasized as a way to improve corporate performance. In contrast to burnout, work engagement means an attitude of organizational members who display vigor about, dedication to and absorption in their work (Schaufeli et al., 2002). Specifically, the key factor to activate work engagement includes job resources; an extensive amount of studies exists on this subject (Schaufeli and Bakker, 2004).

Boundary spanner creativity is the key to securing customer satisfaction and competitive advantage (Strutton et al., 2009). This means developing customized solutions to resolve customer problems and thus requires employees’ creative thinking (Coelho et al., 2011; Wang and Netemeyer, 2004). For salespeople, the range of decision-making and autonomy are clearly defined, but boundary spanners often make creative decisions of their own. Thus, as Wang and Netemeyer (2004) defined in their study, we saw boundary spanner creativity as generating numerous new ideas and visible actions while performing certain tasks. Boundary spanner creativity continues to face issues and complex situations requiring creative solutions (Sousa and Coelho, 2011). Creativity enables boundary spanners to resolve customer issues and meet excessive demands. In other words, they improve and upgrade customers’ perception of services at customer contact points (Bitner et al., 1990). Wang and Netemeyer (2004) indicated that capabilities of leveraging different and unique perspectives can help achieve task objectives. Boundary spanner creativity has a positive impact on work performance. Job performance is related to how boundary spanners meet their individual goals (including quotas allocated to the salesperson) and how they take advantage of the active and non-structural nature of pre-order services in a more flexible and creative way. Thus, individuals with high creativity tend to build and maintain relations more easily and are better positioned to achieve greater performance (Agnihotri et al., 2014). Sousa and Coelho (2011) said that personal value, organizational commitment and customer orientation were driven by employees’ creativity and Coelho et al. (2011) said that internal motivation, work complexity and customer relationships had a positive effect on creativity. Based on these theories, the following hypotheses were established:

\[ H_{3} \] Work engagement of salespeople has a positive effect on boundary spanner creativity.
2.5 Moderating effect of entrepreneurship

The definition of entrepreneurship varies among scholars. With regard to entrepreneurship, three key factors – risk taking, progressive and innovativeness – are considered, and these factors are also key elements of business success (Wang, 2008). Kaufmann and Dant (1988) defined entrepreneurship using three factors. First, they defined it with respect to individual personalities that are unique to entrepreneurs. Second, they defined it with an emphasis on the process and results of entrepreneurship. Third, they defined it with a focus on the behaviors of entrepreneurs in the entrepreneurial role. Mintzberg (1989) defined entrepreneurs as those who lead an organization, motivate employees, collect necessary information and keep changing and reframing the organization to respond to changing environments. Burisch (2002) explained it as personal resources to overcome emotional exhaustion likely to occur during job performance; these personal resources have the functionality to help meet personal goals, provide protection against external risks associated with psychological and physical costs and promote personal growth and development (Judge et al., 2004).

Shane et al. (2003) defined entrepreneurship as entrepreneurial opportunities and saw it as a process of identifying business opportunities, developing ideas to act on, fabricating products or services, assessing feasibility, designing the organization, combining resources and expanding and creating markets. In this study, we define entrepreneurship as the status of having an entrepreneurial mindset, identifying business opportunities in the process of sales from a salesperson’s perspective and executing diverse activities in serving customers to seize these opportunities. For the impact of market orientation on business performance, Li et al. (2008) and Hernández-Maestro and González-Benito (2011) assessed the moderating effect of entrepreneurship in their studies to determine its effect on service quality and business performance. As defined in these studies, we assumed that entrepreneurship would have a meaningful moderating effect on boundary spanner creativity and thus established the following hypothesis:

H4. Entrepreneurship positively moderates the effect on salespeople’s work engagement on boundary spanner creativity.

2.6 Research model

In the theoretical review and establishment of hypotheses, research on emotional labor, work engagement, boundary spanner creativity, customer stewardship and entrepreneurship were discussed. For the elements of emotional labor, deep and surface acting were suggested. For the work engagement of salespeople, we focused on the factors of vigor, dedication and absorption. Finally, we propose the model below (Figure 1).

3. Research method and analyses
3.1 Operational definition of variables and measurements

In this study, diverse measurement items were assessed and analyzed. First, in emotional labor, deep and surface acting are defined from employees’ perspectives. Work engagement, boundary spanner creativity, customer stewardship and entrepreneurship are also measured with existing scales to promote sales and were defined to establish six base constants in total.

First, emotional labor was defined as an effort to express the emotion required by a corporation for successful job performance, with tone of voice, facial expressions and gesture (Grandey, 2000), and to measure surface acting in emotional labor, the study
adopted nine items that Diefendorff et al. (2005) developed for deep acting after moderate adjustment.

Customer stewardship was defined as a mindset to feel satisfied when employee sacked for the sake of the organization and for the common good rather than being selfish or individualistic (Davis et al., 1997a, 1997b). Based on Schepers et al. (2012) study, five measurement items were adopted to assess salespeople’s customer stewardship. Work engagement was defined as personal passion, effectiveness and positive emotional motivation, such as vigor, dedication and absorption. For this study, work engagement was measured by the Utrecht Engagement Scale with nine items (UWES-9; Schaufeli et al., 2006). The scale has three dimensions, comprising vigor (three items), dedication (three items) and absorption (three items).

Boundary spanner creativity was defined as creative thinking and unique behaviors to better perform tasks related to sales (Wang and Netemeyer, 2004); seven items Agnihotri et al. (2014) suggested were adopted to ensure that salespeople assess themselves and to determine how often they are engaged in creative thinking and behaviors. Finally, for entrepreneurship, three sub-dimensions that Jambulingam and Nevin (1999) and Matsuno et al. (2002) defined were adopted. These items were adjusted so as not to lose focus on the personal traits or capabilities required for individuals to create new value in assessing entrepreneurship. The multidimensional construct of entrepreneurship were consisted of risk taking, innovativeness and proactiveness, and three measurement items were used to measure each sub-dimension.

3.2 Sampling procedure and data collection

For the study, a survey was performed with salespeople working for a multi-level sales company in Korea. The membership-based direct sales company was founded in 1951, and Korea headquarters opened in 1991. It now has the number-one market-share in the industry, offering an extensive range of brand lines from daily goods to home and living brands and health products. It was decided after a discussion with the company to conduct the survey on their intranet website to which salespeople have exclusive access, and an assessment was performed based on their experiences with product sales over the most recent three months. The website on which the survey was conducted was the company’s homepage that salespeople frequently access to order corporate products, communicate with the company or other salespeople and check their personal information, including sales
performance. Salespeople participating in the survey were given cash points to buy goods from the company. The survey was conducted over six days starting on April 1, 2014, and 1,620 questionnaires were collected and analyzed. Among the respondents, 1,265 (78.1 per cent) were female, and the remaining 355 (21.9 per cent) were male. With regard to age, 640 respondents were aged in their 40s (39.5 per cent), followed by 579 (35.7 per cent) in their 30s, 303 (18.7 per cent) in their 50s and 98 (6.1 per cent) in their 20s. With regard to educational background, 1,443 respondents (89.1 per cent) were college students or graduates, 129 (8 per cent) were graduate school students or graduates, 31 (1.9 per cent) were high school graduates and 17 (1 per cent) were others.

3.3 Measurement model analysis and confirmatory factor analysis results
Measurement properties and hypotheses were evaluated using multistep structural equation modeling with LISREL 8.53. A two-stage data analysis was performed to assess the measurement quality of the constructs and test the proposed model and hypotheses. In the first stage, a confirmatory factor analysis (CFA) was performed to assess the measurement model. In the second stage, conditional process modeling (Hayes and Matthes, 2009) was fitted to test the moderated hypotheses. In this stage, the moderating effects of stewardship and entrepreneurship and the mediating effect of work engagement on boundary spanner creativity were tested by means of the bootstrapping method.

The first step in the CFA analysis was to test the hypothesized measurement relationships and evaluate the reliability and discriminant validity of the constructs. The measurement model in this study consists of 43 reflective indicators and six correlated latent factors corresponding to the six constructs of the study (Figure 1).

The multidimensional scale construct of work engagement was analyzed at the second-order factor level to examine the relationships among constructs. To this end, a six-construct CFA was estimated using the covariance matrix as an input.

After the deletion of poorly loading items, the final confirmatory factor model fit the data well. The chi-square (df) was 3096.37 (419), goodness-of-fit index (GFI) was 0.88, comparative fit index (CFI) was 0.98 and the root mean squared error approximation (RMSEA) was 0.067. In addition, the hypothesized factor loadings were all statistically significant at the 0.01 level, and the completely standardized factor loadings were all well above the recommended level of 0.50 (Table I). Table II reports the number of items, factor loading, Cronbach’s alpha, composite reliability and average shared variance estimates.

As shown in Tables II and III, correlation coefficients are estimated from LISREL 8.54, and all were significant at the 0.01 level. In addition, all average variance extracted (AVE) exceed 0.50, showing construct validity. The results showed that discriminant validity exists when the proportion of AVE in each construct exceeds the square of the coefficient representing its correlation with other constructs (Fornell and Larcker, 1981). Therefore, the results of the CFA provided support for the reliable measurement of the model, which enabled me to go ahead and test the hypotheses of this study.

We also tested uni-dimensionality of entrepreneurship construct used in this study. As a multi-dimensional construct, entrepreneurship construct was examined with second-order factor analysis. Results showed that the three-factor solution for entrepreneurship is most appropriate. Compared to the one-factor solution, the three-factor solution shows a significant $\chi^2$ difference ($\chi^2$ difference = 88.33 (3) $p < 0.01$).

3.4 Hypotheses testing
To directly test the proposed research model, as shown in Figure 1, two approaches were used. First, to test the direct relationships among constructs, structural equation modeling
<table>
<thead>
<tr>
<th>Feature</th>
<th>Category</th>
<th>N</th>
<th>(%)</th>
<th>Feature</th>
<th>Category</th>
<th>N</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>20's</td>
<td>98</td>
<td>6.1</td>
<td>Gender</td>
<td>Male</td>
<td>355</td>
<td>21.9</td>
</tr>
<tr>
<td></td>
<td>30's</td>
<td>579</td>
<td>35.7</td>
<td>Female</td>
<td>1265</td>
<td>78.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>40's</td>
<td>640</td>
<td>39.5</td>
<td>Less than a year</td>
<td>131</td>
<td>8.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>50's or older</td>
<td>303</td>
<td>18.7</td>
<td>1 year</td>
<td>434</td>
<td>26.8</td>
<td></td>
</tr>
<tr>
<td>Educational backgrounds</td>
<td>High school graduates</td>
<td>31</td>
<td>1.9</td>
<td>2 ~ 3 years</td>
<td>420</td>
<td>25.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>College students</td>
<td>423</td>
<td>26.1</td>
<td>4 ~ 5 years</td>
<td>217</td>
<td>13.4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>College graduates</td>
<td>1020</td>
<td>62.0</td>
<td>6 ~ 9 years</td>
<td>146</td>
<td>9.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Graduate school students/graduates</td>
<td>129</td>
<td>8.0</td>
<td>10 years or longer</td>
<td>272</td>
<td>16.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>17</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
with LISREL 8.5 was used (Jöreskog and Sörbom, 1996). The overall fit of this model was good. The chi-square (df) was 1975.14 (166), CFI was 0.97, GFI was 0.88 and NFI was 0.96. The structural estimates of this model are shown in Table IV. As shown, the analyses provided support for all direct hypothesized relationships.

H1a and H1b pertained to emotional labor and its influences on employee work engagement. The results indicated that deep acting exhibited the predicted positive influence on employee work engagement (standardized coefficient value of −0.34, p < 0.01), and surface acting was negatively related with employees’ work engagement (standardized coefficient value of 0.12, p < 0.05). As a job resource, deep acting increased employee’s work engagement; however, surface acting, as a job demand, diminished employee’s work engagement. Therefore, H1a and H1b were supported.

In addition, the influence of work engagement on boundary spanner creativity was tested. The results showed that work engagement had a positive influence on frontline employees’ creativity (H3: standardized coefficient value of 0.62, p < 0.01). Thus, employees who are highly engaged in their work showed more creative behavior to need customer’s unique needs. Therefore, H3 was supported.

To directly test our proposed moderating effects in the research model, we used a regression-based path analysis with the aid of existing computational tools for estimating and probing interactions and conditional indirect effects in moderated mediation models (Hayes and Matthes, 2009; Preacher et al., 2007). We used an SPSS macro (Preacher et al., 2007) to estimate both the mediation and moderation models.

Tables V shows results from the moderated mediation model. Table V shows a negative and significant relationship between surface acting and stewardship, providing support for H2b. The results from the mediation model indicate that the interaction effect of employees’ surface acting with stewardship was negatively associated with work engagement (β = −0.06, p < 0.05). However, stewardship has no significant moderating effect on the link between deep acting and work engagement, resulting in a lack of support for H2a.

Next, in the right side of Table V, the results also show a positive interaction effect of work engagement with entrepreneurship on employees’ creativity, according to the different type of emotional labor as influential factor respectfully (β = 0.14, p < 0.05, IV = deep acting and β = 0.03, p < 0.05, IV = surface acting). Therefore, employees who have more entrepreneurship showed more positive relationship between work engagement and boundary spanner creativity. Thus, H4 was supported.

4. Discussion
This study extends and links existing research in the areas of emotional labor, work engagement, boundary spanner creativity, customer stewardship and entrepreneurship using the job resource and demand model as a theoretical base. To extend our knowledge on the emotion labor, the study was conducted based on the theories of

<table>
<thead>
<tr>
<th>Construct</th>
<th>Path loading</th>
<th>C/R</th>
<th>Cronbach’s alpha</th>
<th>AVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep acting</td>
<td>0.82-0.95</td>
<td>0.94</td>
<td>0.945</td>
<td>0.81</td>
</tr>
<tr>
<td>Surface acting</td>
<td>0.72-0.90</td>
<td>0.89</td>
<td>0.890</td>
<td>0.67</td>
</tr>
<tr>
<td>Work engagement</td>
<td>0.73-0.87</td>
<td>0.90</td>
<td>0.942</td>
<td>0.62</td>
</tr>
<tr>
<td>Customer stewardship</td>
<td>0.86-0.92</td>
<td>0.91</td>
<td>0.912</td>
<td>0.72</td>
</tr>
<tr>
<td>Boundary spanner creativity</td>
<td>0.74-0.88</td>
<td>0.92</td>
<td>0.922</td>
<td>0.67</td>
</tr>
<tr>
<td>Entrepreneurship</td>
<td>0.69-0.80</td>
<td>0.90</td>
<td>0.901</td>
<td>0.56</td>
</tr>
</tbody>
</table>

Table II. Measurement items and CFA results
<table>
<thead>
<tr>
<th>Construct</th>
<th>Average</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Deep acting</td>
<td>3.987</td>
<td>0.695</td>
<td>0.81</td>
<td></td>
<td>0.67</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Surface acting</td>
<td>2.618</td>
<td>0.862</td>
<td>-0.028 (0.000)</td>
<td></td>
<td>0.67</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Work engagement</td>
<td>3.998</td>
<td>0.693</td>
<td>0.553** (0.306)</td>
<td>-0.064** (0.004)</td>
<td>0.62</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Customer stewardship</td>
<td>3.998</td>
<td>0.706</td>
<td>0.649** (.421)</td>
<td>-0.060* (.003)</td>
<td>0.629** (0.395)</td>
<td>0.72</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Boundary spanner creativity</td>
<td>3.387</td>
<td>0.657</td>
<td>0.443** (0.196)</td>
<td>0.083** (0.006)</td>
<td>0.657** (0.431)</td>
<td>0.520** (0.270)</td>
<td>0.67</td>
<td></td>
</tr>
<tr>
<td>6. Entrepreneurship</td>
<td>3.579</td>
<td>0.600</td>
<td>0.421** (0.177)</td>
<td>0.035 (0.001)</td>
<td>0.544** (0.295)</td>
<td>0.451** (0.203)</td>
<td>0.599** (0.358)</td>
<td>0.56</td>
</tr>
</tbody>
</table>

Notes: *p < 0.05; **p < 0.01; Diagonal: AVE; () means square value of coefficient
emotional labor to see how performance factors affect boundary spanners. In the previous studies, researchers applied common job-related factors to salespeople, but in this study, to expand the scope, we attempted to consider and reflect sentiments and work characteristics unique to salespeople. Especially, this study includes employee’s personal factors such as customer stewardship and entrepreneurship as moderators and examined the interaction effects in the relationship among emotional labor, work engagement and boundary spanner creativity.

Findings from the analysis of the survey of salespeople working for a direct membership-based sales company are as follows. First, $H1a$ assumed that deep acting would have a positive effect on work engagement in emotional labor and that surface acting would have a negative effect, as defined in $H1b$; both of these hypotheses were supported. This means the passive management of emotion, or controlling salespeople’s emotional expressions on the surface, would have a negative impact on work. In other words, our results suggest that the resource depletion possibility seems a likely concern in relation to the development of employees work engagement within sales environments where high levels of self-regulation would be expected.

Next, $H2a$ and $H2b$ focused on the effect of customer stewardship of salesperson in the relationship between deep/surface acting and work engagement in emotional labor. The outcome of the analysis using bootstrapping showed, with the moderating variable of customer stewardship, that deep acting did not have a significant effect on work engagement in emotional labor, so $H2a$ was not supported. However, results showed that perceived customer stewardship weakens the negative effect of surface acting on work engagement. General employees who have more customer stewardship showed more tolerant attitudes toward disguised and regulated emotional display and regarded it as a job resource. Thus, by monitoring and managing employee’s customer stewardship levels, managers can reduce the detrimental effects of stressful surface acting.

This study suggests the internal benefit of salesperson’s work engagement. The analysis of $H3$ shows how the work engagement of salespeople influenced on boundary spanner creativity. Ultimately, to salespeople, work engagement means being motivated for sales work and becoming engaged in creative sales activities. As shown in the results, work engagement is the driver of employees’ creativity. Considering the positive results of work engagement, perhaps most obvious is the suggestion that work engaged workers should be placed in high-customer-contact positions to magnify internal benefits to build external profit. Of greater concern, perhaps, is the placement of a worker who has a lower work engagement in a high-contact position.

Finally, the higher level of entrepreneurship salespeople had, the greater the positive effect on work engagement and boundary spanner creativity. In other words, salespeople with a higher level of entrepreneurship were more passionate and eager to be engaged in creative sales activities. Accordingly, $H4$ was empirically supported.

<table>
<thead>
<tr>
<th>Category</th>
<th>Hypothesis path</th>
<th>Loading</th>
<th>Standard error</th>
<th>$t$</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>$H1a$</td>
<td>Deep acting $\rightarrow$ Work engagement</td>
<td>0.60</td>
<td>0.03</td>
<td>21.84</td>
<td>H1 support</td>
</tr>
<tr>
<td>$H1b$</td>
<td>Surface acting $\rightarrow$ Work engagement</td>
<td>-0.05</td>
<td>0.02</td>
<td>-2.23</td>
<td>H2 support</td>
</tr>
<tr>
<td>$H3$</td>
<td>Work engagement $\rightarrow$ Boundary spanner creativity</td>
<td>0.68</td>
<td>0.03</td>
<td>22.72</td>
<td>H4 support</td>
</tr>
</tbody>
</table>

Table IV. Results of structural equation

Notes: $\chi^2 = 1975.14; p = 0.00; df = 166; RMSEA = 0.086; RMR = 0.048; GFI = 0.88; CFI = 0.97; NFI = 0.96; RFI = 0.96$
### Table V. Process model analysis outcome

<table>
<thead>
<tr>
<th>Analysis stage</th>
<th>Moderating variable: work engagement</th>
<th>Dependent variable: boundary spanner creativity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\beta$</td>
<td>$t$</td>
</tr>
<tr>
<td><strong>Stage 1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>0.00</td>
<td>0.23</td>
</tr>
<tr>
<td>Deep acting</td>
<td>0.24</td>
<td>9.94</td>
</tr>
<tr>
<td>Customer stewardship</td>
<td>0.45</td>
<td>18.42</td>
</tr>
<tr>
<td>Interaction (H2a)</td>
<td>−0.01</td>
<td>−0.61</td>
</tr>
<tr>
<td>Interaction (H4)</td>
<td>0.14</td>
<td>2.14</td>
</tr>
<tr>
<td>$R^2 = 0.432, F = 409.79$</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Stage 2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>−0.00</td>
<td>−0.18</td>
</tr>
<tr>
<td>Surface acting</td>
<td>−0.01</td>
<td>−0.68</td>
</tr>
<tr>
<td>Customer stewardship</td>
<td>0.61</td>
<td>32.19</td>
</tr>
<tr>
<td>Interaction (H2b)</td>
<td>−0.06</td>
<td>−3.40</td>
</tr>
<tr>
<td>Interaction (H4)</td>
<td>0.03</td>
<td>1.97</td>
</tr>
<tr>
<td>$R^2 = 0.400, F = 339.99$</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>$R^2 = 0.518, F = 434.81$</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Effects of emotional labor
The study was designed to expand studies on the management of salespeople’s emotions, going beyond organization or customer-oriented perspectives and reviewing it based on the core job competence of salespeople, as previous studies have not covered. How work engagement works and its effect on boundary spanner creativity in the emotional labor of salespeople was reviewed. The study was designed to determine the moderating effect of customer stewardship and salespeople’s entrepreneurship. The findings of the study would be meaningful starting points for diverse academic and practical discussions.

First, hypotheses on the effect of emotional labor perceived by salespeople on work engagement were all supported. Deep acting in emotional labor has a positive effect on work engagement, whereas surface acting has a negative effect. Most studies covered emotional burnout or depletion, in contrast to emotional labor or work engagement, but in this study, more direct factors of emotional labor were assessed to detect positive effects. More specifically, with regard to deep acting, when salespeople did their jobs, it had a positive effect on the work when they behaved voluntarily and proactively. With regard to surface acting, the study supported outcomes from previous studies that it had a negative effect on emotional burnout and work engagement. This means when salespeople were forced to fake their feelings, they were more likely to recognize stress or burnout due to emotional dissonance between what they really felt and what they had to express to comply with organizational regulations. Second, it was validated that customer stewardship had a moderating effect on the relations between deep/surface acting and work engagement in emotional labor. However, deep acting in emotional labor did not show a moderating effect. This indicates that in deep acting, salespeople already had self-regulated stewardship for customers. Customer stewardship is a psychological factor salespeople perceive, and elements of customer stewardship include voluntary self-management and regulation of salespeople for customers. To ensure this, sustainable social environments and structures need to be developed. Self-management supported by various techniques and researches is required for training at an individual level and team level. Third, boundary spanner creativity was verified to have a positive effect on the work engagement of salespeople. As Sousa and Coelho (2011) and Coelho et al. (2011) suggested in their study, boundary spanner creativity was proven to have positive effect on work engagement. This means it is important to maintain interaction with customers, including adaptive behaviors and customer orientation, as demand from customers increases. Additionally, in approaches to customers’ demands, additional flexibility is required, and it is important to adopt an extensive solution to this issue. In other words, addressing customers’ issues in boundary spanner creativity is the key to performance improvement.

Finally, the greater the level of entrepreneurship, the more positive the effect work engagement tended to have on boundary spanner creativity. The individual competence and capability of salespeople are directly related to interaction with customers, so when the right strategy is defined for each type of entrepreneurship of salespeople, it will create a positive corporate culture and lead to performance improvement. From the manager’s perspective, managing employee’s entrepreneurship is not easy to control. However, if managers can recruit and place employees who have more entrepreneurship the managers will increase the positive effect of work engagement leading to better creativity.

This study reviewed how work engagement in emotional labor affected salespeople’s boundary spanner creativity. However, the study has certain limitations.

First, most previous studies have focused on salespeople’s emotional labor from customers’ perspectives. However, in this study, salespeople’s emotional labor was reviewed from salespeople’ perspectives, and the need to more deeply study the issue from...
salespeople’s perspectives was identified. Furthermore, it is necessary to consider various other factors like the importance of products, characteristics, brand and image, in addition to focusing only on the aspect of emotional labor. Thus, it would be meaningful to further study how these diverse variables would affect emotional aspects of salespeople’s work.

Second, in this study, verification of a moderating effect in salespeople’s emotional labor was limited only to customer stewardship and salespeople’s entrepreneurship. Further study to determine the effect of individual preference of salespeople to reflect their characteristics would be meaningful.

Third, the data in the study were collected from salespeople of a direct membership-based sales company. Salespeople in a single direct membership-based sales company cannot represent the entire group of salespeople in diverse industries; thus, it would be premature to draw generalized conclusions from the study. Given this, it would be necessary to further study salespeople and emotional labor workers in diverse industries to draw more generalized conclusions.

References


About the authors
Jaewon Yoo is an Assistant Professor in the Entrepreneurship and Small Business Department at Soongsil University in Seoul, South Korea. He received his PhD in Marketing from Oklahoma State University in 2011, and his areas of expertise include customer co-production, customer-to-customer interaction and frontline employee management. He has published many papers in various journals, such as the Journal of Service Research, Journal of Personal Selling and Sales Management, Journal of Business Research, Journal of Services Marketing, European Journal of Marketing and Service Industries Journal. Jaewon Yoo is the corresponding author and can be contacted at: yjw1774@ssu.ac.kr

Jicheol Jeong is a PhD Candidate in the Entrepreneurship and Small Business Department at Soongsil University in Seoul, South Korea. He received his PhD in Marketing from Soongsil University in 2017, and his areas of expertise include frontline employee management, distribution, small business and franchise. He has published many papers in various journals, such as the Asia Pacific Journal of Small Business, Korean Corporation Management Review and Management Education Review.

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The impact of brand concept on brand equity
Joo-Eon Jeon
Department of Business Administration, Anyang University, Anyang, South Korea

Abstract

Purpose – Researches on the impact brand equity have grown considerably in recent years, as it has been shown to have significant impact on a company’s financial performance. This paper aims to empirically test the relationships between brand concepts and brand equity, while exploring the mediating roles of emotional attachment and customer commitment.

Design/methodology/approach – The research investigates the effect of brand concept on the customer–brand relationship and brand performance. Additionally, it examines how the relationship between brand concept and brand equity is mediated by customer–brand relationships such as emotional attachment and commitment.

Findings – The results empirically demonstrate the important contribution of the three brand concepts to brand equity. The results empirically demonstrate the important contribution of the three-brand concept to customer commitment and to brand equity that has been predicted by prior research.

Originality/value – The main contribution of this study is to demonstrate the effects of the brand concepts related to aesthetic, functional and symbolic benefits on brand equity. From this, brand equity may be viewed as a link in the path of effects that indirectly connects brand concepts with market performance. Brand concept, emotional attachment and customer commitment are relevant constructs underlying brand equity, and commitment and loyalty are key mediating variables in relational exchanges.

Keywords Brand concept, Commitment, Brand equity, Emotional attachment

Paper type Research paper

1. Introduction
The importance of brand equity has been recognized in the marketing literature for at least three decades as an intangible asset that promotes firm performance. Brand equity has been shown to make an impact on brand loyalty and the financial value of the company (Chaudhuri and Holbrook, 2001; Oliver, 1999; Srivastava et al., 1998). Research on brand equity has evaluated the importance of the brand in marketing strategy and has sparked managerial interest. Brand equity has also been defined in a number of different ways for different purposes and has been addressed using comparative methods, holistic methods and the interplay between branding and financial considerations.

Aaker (1991) has discussed the role of customer commitment in brand equity management and has specifically noted that strong commitment leads to competitive advantages such as reduced marketing costs and attracting new customers. An important
determinant of a customer commitment is a brand manager’s abilities to select a brand concept (Chaudhuri and Holbrook, 2001; Park et al., 1986). A brand concept is selected brand image derived from consumer needs (Park et al., 1986) and is the culmination of a diverse array of direct and indirect brand equity features such as brand awareness and brand identity. That is, brand management is a process of selecting a concept. Prior researchers have assigned products to one of three categories on the basis of product class: functional (e.g. massagers), symbolic (e.g. watches) or aesthetic (e.g. artwork). A product may be a physical good like an automobile, a watch or a pencil, or it can be a service like a bank, a hotel or an airline. This research, however, uses the terms functional, symbolic and aesthetic to refer to the benefit created in a brand, not as a product class (Malär et al., 2011; Park et al., 1986). The brand benefit is a perception created by marketers’ management of the brand. As a result, author expects that this brand concept is an antecedent of strong brand relationship.

Recently, increasing interest among brand manager has focused on strong brand relationships because they reflect customer loyalty through emotional attachment, and commitment (Fournier, 1998; Morgan and Hunt, 1994; Oliver, 1999). Commitment represents professed faithfulness and loyalty to the brand (Fournier, 1998). Emotional attachment is affinity towards the brand, with respect to other available alternatives. Emotional bonds may range from feelings of warmth to true passion (Thomson et al., 2005). Marketing managers are able to justify expenditures on promotions that have the potential to generate such long-term consumer effects as emotional attachment and customer commitment (Brakus et al., 2009; Chaudhuri and Holbrook, 2001; Malär et al., 2011). Furthering understanding of the process of developing the brand relationship and the notion of brand equity will benefit from an empirically supported explanation for these crucial brand concepts.

The purpose of this research is to present a path model that would provide useful structure for managers developing brand concept management and researchers studying brand equity. To define the brand concept construct, this paper begins with a review of marketing research, which examines when brand concepts and how they affect attachment, commitment and brand equity. The present study explores the relationships between emotional attachment, commitment and brand equity with an emphasis on understanding the linking role played by brand concept. To develop hypotheses, the authors draw from the new and emerging concepts of customer-brand relationship and brand equity. These conceptualizations are crucial aspects of an integrated process of brand fortification and brand performance. The author then presents the methods, measures and results of surveys designed to test the hypotheses of interest. Finally, the study concludes with a discussion of the results in terms of their managerial relevance and implications for future research.

2. Theoretical background
Previous research has determined that a brand is a name, term, sign, symbol, design or signalling combination that is intended to identify the goods and services of one seller or group of sellers (Aaker, 1991; Kotler and Armstrong, 2010). As a concept, branding has been around for decades as a means to distinguish the goods of a particular producer. Park et al. (1986) have suggested that the long-term success of a brand depends on selecting a brand concept prior to market entry. These authors define brand concept in terms of firm-selected brand meaning derived from consumer needs. Specially, a brand concept consists of an aesthetic, functional and symbolic brand (Park et al., 2013), which represent distinct constructs.
The aesthetic brands are designed to fulfil consumer’s needs for sensory pleasure (Jeon and Lee, 2016). “Aesthetics” comes from the Greek word aesthetic, referring to sensory perception and understanding (Krishna et al., 2010; Kumar and Garg, 2010). In the eighteenth century, the philosopher Baumgarten picked up the term and changed its meaning into gratification of the senses delight (Goldman, 2001). Aesthetic experiences are becoming increasingly relevant to the marketing due to growing importance of experiential aspects of consumption (Hirschman and Holbrook, 1982). Aesthetic appeal and design have been of interest to human beings and have captured their imagination throughout history (Patrick and Hagtvedt, 2011; Krishna et al., 2010). Aesthetic experiences can have a deep-rooted influence on consumer affect, cognition and behaviour. In a marketing context, aesthetic needs are defined as desires for products that provide aesthetic pleasure. When consumers take product quality for granted, aesthetics becomes an important criterion (Park et al., 1986; Park et al., 2013) in the purchasing decision. Aesthetics have been investigated in the visual sense, but other senses, for example, taste, smell and the interaction of senses, do constitute aesthetic experiences in traditional marketing research (Krishna et al., 2010). The full form of appreciation of an aesthetic experience comes from the combination of sensory input (Kumar and Garg, 2010).

The functional brands should emphasize the functional performance. Prior research has defined functional value as the ability to perform functions in the everyday life of a consumer (Hirschman and Holbrook, 1982). Functional needs are defined as those that motivate the search for products that solve consumption-related problems (Park et al., 1986; Park et al., 2013). These needs are linked to basic motivations and are met by products with functional performance. Therefore, a functional brand is designed to solve externally generated consumption needs (Chaudhuri and Holbrook, 2001; Brakus et al., 2009). Park et al. (2010) indicate that brands can be managed to reduce uncertainty in consumers’ lives and enable the attainment of desired outcomes by facilitating control and efficacy. Hence, functional brands are related to product performance. Brands with visual representations of functional benefits are capable of reminding customers of the brand’s functionality and/or communicating such benefits to them (Keller, 1993).

The symbolic brands should emphasize the relationship between brand and self-identification. These brands can reflect a part of consumer’s identities. Park et al. (2013) defined self-expressiveness brand as the brand with symbolic concept. Brands have the ability to help express or define customers’ actual or desired selves and to differentiate customers’ selves from those of others (McCracken, 1990). Brands also become relevant to customers by connecting the individual to others who share similar values and beliefs. Symbolic needs are defined as desires for products that fulfil internally generated needs for self-enhancement, social role or ego-identification (Holbrook and Hirschman, 1982). A symbolic brand benefit is one that is designed to associate the individual with a desired group, role or self-image (Park et al., 1986). Consumers may value the prestige, exclusivity or fashionability of a brand because it relates positively to their self-concept. A symbolic brand can be a critical tool for conveying associations between the brand and the self, which in turn helps the consumer see the brand as part of themselves (Hirschman and Holbrook, 1982). Brands with symbolic benefits have the potential to not only express brand-self associations but also to reinforce and strengthen them, thus enhancing customers’ willingness to exert effort and invest resources towards sustaining their relationship with the brand (McCracken, 1990; Park et al., 2010).

This research proposes that the aesthetic, functional and symbolic brands are each related to both emotional attachment and commitment. This proposition stems from the emerging theory of brand commitment in relationship marketing (Fournier, 1998; Morgan
and Hunt, 1994). In the context of maintaining brand relationships, the emotional determinants of brand commitment need to be considered separately. Brand commitment leads to greater market performance when the same brand is repeatedly purchased by consumers, irrespective of situational constraints (Fournier, 1998). Research has also shown that superior brand performance outcomes such as greater market share may result from greater customer commitment (Park et al., 2010). This commitment, in turn, may be determined by clear brand concept. Therefore, the initial goal of this research is to clearly conceptualize these constructs and suggest the path of each construct towards the overall brand conceptualization.

3. Hypotheses development
3.1 Aesthetic brand concept and sensory experience
For brands with aesthetic benefits, brand strategies should convey the brand’s effect on sensory satisfaction. Using the brand should highlight the aesthetic aspects associated with consumption. Brands with aesthetic benefit are designed to fulfil internally generated needs for aesthetic pleasure (Park et al., 1986) and are more likely to build connections with their customers than are brands with low aesthetic qualities (Goldman, 2001). Thus, the aesthetic benefit of brand is an important component of a brand’s ability to appeal to customers and has the potential to emotionally connect with them, thereby enhancing their brand loyalty.

According to prior research, sensory experience is fundamental to the formation of aesthetic stimuli (Brakus et al., 2009; Hirschman and Holbrook, 1982). Therefore, the sensory experience is an important platform for enabling the brand to differentiate itself and create an opportunity for intense consumer relationships (Patrick and Hagtveld, 2011). The positive impact of the brand with aesthetic benefit will affect sensory experience. Based on this theoretical background, the following hypothesis is proposed:

H1. Brands with aesthetic benefits are positively related to sensory experience.

3.2 Functional brand concept and customer commitment
This research expects brands that convey functional benefits will encourage customers to rely on the brand as a solution for consumption-related problems, thereby enhancing customers’ brand commitment. As a result, functional brands may have the potential to communicate and reinforce a brand’s promise to assist customers in their daily lives and, in so doing, can strengthen customers’ relationships with the brand (Morgan and Hunt, 1994; Park et al., 2013). Satisfaction with functional brands appears to serve as a key determinant of customer commitment, consistent with the concept of brand management (Fournier, 1998).

Commitment has been defined as an enduring desire to maintain a customer–brand relationship (Moorman et al., 1992). Fournier (1998) suggested that commitment represents a high-quality brand relationship. Thus, customer commitment underlies a continued valuable relationship that has been created by customer satisfaction. In a marketing context, consumers with commitment intend to continue a long-term relationship and have a willingness to remain in the relationship (Chaudhuri and Holbrook, 2001; Oliver, 1999). Consumers who are satisfied with functional brands are committed to preserving the relationship with the brand. Therefore, satisfaction with a functional brand and consumer commitment should be related, as satisfaction is important in the relational exchange (Oliver, 1999).

The information-processing paradigm regards consumer behaviour as largely objective and rational when oriented towards problem solving (Moorman et al., 1992; Chaudhuri and Holbrook, 2001). Thus, customer trust in a particular favoured functional brand may be greater
when the utilitarian value in the product category is high in terms of tangible product attributes, such as quality or convenience. Furthermore, Chaudhuri and Holbrook (2001) found that the functional value of brand was significantly and negatively related to emotional response. Based on this theoretical background, the following hypothesis is proposed:

H2. Brands with functional benefits are positively related to commitment.

3.3 Symbolic brand concept and emotional attachment
This research proposes that brands with symbolic benefits are related to both sensory experiences and emotional attachment. This proposition stems from the emerging theory of brand commitment in relationship marketing (Fournier, 1998). Park et al. (2010) defines brand attachment as the strength of the bond connecting the brand with the self. This bond is exemplified by a rich and accessible memory network that involves thoughts and feelings about the brand and the brand’s relationship to the self (Thomson et al., 2005). Consumers can be connected to a brand because it represents who they are or because it is meaningful in light of goals, personal concerns, or life projects (McCracken, 1990). The idea that attachment involves an emotional bond suggests that a critical aspect of attachment involves the connection between the brand and the self, defined here and elsewhere as brand–self connection (Escalas, 2004a, 2004b).

Brand–self connection is a core component of attachment because it reflects the definition of attachment as the bond connecting a person with the brand (Thomson et al., 2005). In this study, emotional attachment is defined as a brand’s potential to elicit a positive emotional response in the average consumer as a result of its use (Thomson et al., 2005). Attachment is increasingly viewed in terms of the aesthetic elements of brand symbolism and cultural significance, and the emotions and resonance that these produce in the hearts and minds of consumers (Malär et al., 2011). Furthermore, previous research proposes that a valid measure of emotional attachment should predict consumer’s commitment to a brand and their loyalty to that brand (Thomson et al., 2005). Overall, consumers’ emotional attachment to a brand leads to their commitment to the relationship with that particular brand. Therefore, this research proposes the following hypothesis:

H3. Brands with symbolic benefits are positively related to both sensory experiences and emotional attachment.

3.4 Customer commitment and brand equity
In a general sense, brand equity is defined in terms of the marketing effects that are uniquely attributable to the brand (Aaker, 1991; Keller, 1993; Kotler and Armstrong, 2010). For example, brand equity is evident when certain outcomes that result from the marketing of a product or service due to its brand name would not occur if the product or service did not possess the name (Kotler and Armstrong, 2010). A number of factors influence a company’s brand equity, including the firm’s strategic insights and how effectively the firm implements its chosen strategy. However, one of the key drivers of brand equity is customers’ commitment to the firm’s brand (Srivastava et al., 1998). The extent to which customers are loyal to a firm’s brand influences the stability and growth of the firm’s revenues and profits over time, serving to protect the firm from competitive threats (Srivastava et al., 1998).

Customer commitment can be viewed as an enduring desire to maintain a valued relationship with the brand (Chaudhuri and Holbrook, 2001; Park et al., 2013). Consumers having strong levels of commitment, who have nurtured strong relationships with the brand,
tend to see strong connections between themselves and the brand (Escalas and Bettman, 2003) and consider the brand to be an integral part of their lives. In this study, the authors argue that committed consumers are likely to view brand changes as threatening to their relationship with the brand. This research also proposes that high consumer commitment to a brand is linked through brand equity to greater market share and premium prices in the marketplace. Based on this theoretical background, the following hypothesis is proposed:

\[
H4. \text{ Customer commitment is positively related to brand equity.}
\]

4. Methodology
This study aims to show that brand benefits can explain the relationship between brand concept and brand performance. The research investigates the effect of brand concept on the customer–brand relationship and brand performance. Additionally, it examines how the relationship between brand concept and brand equity is mediated by customer–brand relationships such as emotional attachment and commitment.

4.1 Stimuli
For the stimuli used in this study, the authors drew a random sample of 100 brands from the Interbrand Group published listing. All data are available through The Best Global Brands List. The sample was representative of The Best Global Brands as a whole, as the selected brands do not differ from the remaining firms on any critical financial measure. The Best Global Brands of Interbrand Group factors in many criteria when ranking the world’s most valuable brands such as Apple, Coca-cola, Google and Samsung. The focus of this research is on overall brands rather than individual products, as no data are available for examining the relationship between brands and firm performance at the product level. After selecting the brands, the authors secured official brand logos from the company’s websites.

4.2 Sample and data collection procedure
The authors obtained the sample for this study by recruiting adult survey participants from Amazon’s Mechanical Turk. Four hundred and sixty participants (47.2 per cent male, \(M_{\text{age}} = 38.8\)) completed the survey, for which they received US$0.50. Based on random assignment, each participant evaluated different brands in a questionnaire. The questionnaire included one brand logo on each page, followed by the set of items shown in Table I. Each brand logo in the sample received roughly the same number of survey responses.

4.3 Measures
The items in each measure were assessed on a seven-point Likert scale, where 1 = strongly disagree and 7 = strongly agree (see Appendix). To measure brand concept, the authors adapted six items from the scale by Park et al. (2013). The authors measured sensory experience using three items modelled after Brakus et al. (2009). To measure emotional attachment, the study included a version of the scale that consists of the attachment dimension: affection, passion and connection (Malär et al., 2011). Finally, to measure commitment, the authors adopted three items from the recent work by Park et al. (2013).

For the examination of brand equity, it was important to select a forward-looking and cumulative measure that is comparable across a variety of brands in different industries. In this regard, The Best Global Brands 2015 List of Interbrand Group has received wide acceptance in the current marketing literature as an appropriate measure of brand equity. Its methodology evaluates brands much the same way that analysts value other assets: on the
basis of how much they are likely to earn in the future. Interbrand Group has used a
subjective multiplier of brand profits based on the brand’s performance along seven
dimensions: leadership, stability, market stability, internationality, trend, support and
protection.

5. Results
5.1 Data analysis
The reliability of the measurement items was first tested for internal consistency. The scales
were evaluated to be reliable, showing a satisfactory reliability level of Cronbach’s α at
above 0.7, which is a generally accepted level: aesthetic benefit = 0.939; functional benefit =
0.845; symbolic benefit = 0.877; sensory experience = 0.848; emotional attachment = 0.900;
commitment = 0.941. Next, the authors confirmed convergent validity and discriminant
validity of the measurement through a confirmatory factor analysis (CFA). Table I shows
the overall results from the CFA. Model fit was found to be significant since all of the model
fit indicators were acceptable: root mean square error of approximation (RMSEA) = 0.057;
normed fit index (NFI) = 0.969; comparative fit index (CFI) = 0.980; Turker-Lewis index
(TLI) = 0.972; goodness of fit index (GFI) = 0.938 with $\chi^2 = 224.042, p < 0.001$ (ratio
between chi-square and the number of degrees of freedom = 89). Table II shows the
correlations between constructs.

Figure 1 shows the overall results of hypotheses tests. Solid lines indicate a significant
relationship, whereas dotted lines indicate a non-significant relationship of the data. As the

<table>
<thead>
<tr>
<th>Scale</th>
<th>Factor loadings</th>
<th>Composite reliability</th>
<th>Average variance extracted</th>
<th>Mean (S.D)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aesthetic benefit</td>
<td></td>
<td>0.939</td>
<td>0.885</td>
<td>4.66</td>
</tr>
<tr>
<td>Aesthetic benefit 1</td>
<td>0.925</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aesthetic benefit 2</td>
<td>0.957</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Functional benefit</td>
<td></td>
<td>0.845</td>
<td>0.733</td>
<td>4.11</td>
</tr>
<tr>
<td>Functional benefit 1</td>
<td>0.832</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Functional benefit 2</td>
<td>0.880</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Symbolic benefit</td>
<td></td>
<td>0.877</td>
<td>0.781</td>
<td>3.23</td>
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<tr>
<td>Symbolic benefit 1</td>
<td>0.896</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Symbolic benefit 2</td>
<td>0.872</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensory experience</td>
<td></td>
<td>0.848</td>
<td>0.699</td>
<td>4.09</td>
</tr>
<tr>
<td>Sensory experience 1</td>
<td>0.935</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensory experience 2</td>
<td>0.935</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensory experience 3</td>
<td>0.592</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emotional attachment</td>
<td></td>
<td>0.900</td>
<td>0.751</td>
<td>3.31</td>
</tr>
<tr>
<td>Emotional attachment 1</td>
<td>0.884</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emotional attachment 2</td>
<td>0.866</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emotional attachment 3</td>
<td>0.850</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Commitment</td>
<td></td>
<td>0.877</td>
<td>0.849</td>
<td>3.31</td>
</tr>
<tr>
<td>Commitment 1</td>
<td>0.878</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Commitment 2</td>
<td>0.930</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commitment 3</td>
<td>0.955</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: $\chi^2 = 204.207 (p = 0.000, df = 75);$ RMSEA = 0.061; NFI = 0.969; CFI = 0.980; TLI = 0.972; RMR = 0.091

Table I. Statistics of construct items
authors predicted, the results empirically demonstrate a positive relationship between the three-brand concept and customer commitment and brand equity. The structural equation modelling results show that the brand concepts have a positive and significant impact on customer commitment, which in turn positively influences brand equity.

5.2 Brand concepts and the customer–brand relationship

H1 proposes that when consumers perceive brands to have aesthetic appeal, they are more likely to have a sensory experience. The path between aesthetic brands and sensory experience was significant (0.404), whereas the path between aesthetic brands and emotional attachment was not significant. Additionally, sensory experience is significantly related to emotional attachment (0.428). These results reveal a significant, indirect influence of the aesthetic benefits on emotional attachment, indicating that sensory experience acts as a partial mediator in brands with aesthetic benefit-emotional attachment. These results

Table II.
Correlation between constructs (AVE and squared correlations)

<table>
<thead>
<tr>
<th>Construct</th>
<th>AES</th>
<th>FUN</th>
<th>SYM</th>
<th>SEN</th>
<th>EMO</th>
<th>COM</th>
</tr>
</thead>
<tbody>
<tr>
<td>AES</td>
<td>0.783*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FUN</td>
<td>0.516</td>
<td>0.537*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SYM</td>
<td>0.599</td>
<td>0.648</td>
<td>0.609*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEN</td>
<td>0.684</td>
<td>0.557</td>
<td>0.654</td>
<td>0.488*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EMO</td>
<td>0.540</td>
<td>0.568</td>
<td>0.714</td>
<td>0.669</td>
<td>0.564*</td>
<td></td>
</tr>
<tr>
<td>COM</td>
<td>0.535</td>
<td>0.601</td>
<td>0.698</td>
<td>0.637</td>
<td>0.785</td>
<td>0.720*</td>
</tr>
</tbody>
</table>

Notes: *The numbers on the diagonal are the square roots of the average variance extracted; AES, aesthetic benefit; FUN, functional benefit; SYM, symbolic benefit; SEN, sensory experience; EMO, emotional attachment; COM, commitment

Figure 1.
Hypotheses testing

Notes: \( \chi^2 = 224.042 (p = 0.000, \text{df} = 89); \) RMSEA = 0.057; NFI = 0.966; CFI = 0.979; TLI = 0.972; GFI = 0.938; * \( p < 0.80; ** \( p < 0.05; *** \( p < 0.01 \)
support the hypothesis that brands with aesthetic appeal can be associated with sensory
experience.

As this research predicted, brands with functional benefits affect commitment \( (H2) \). The
direct effect of functional brands on commitment is significant \( 0.115 \), whereas the effect on
either sensory experience and emotional attachment is not significant. That is, functional
brand seems to be a stronger predictor of actual commitment than emotional attachment.
The functional benefit serves as a basic and fundamental descriptor of product category.
This result reveals that brands with functional benefits have an impact on commitment, as
functional brand objectives are rational and oriented toward problem solving.

Finally, the authors predicted that brands with symbolic benefits would be positively
related to both sensory experiences and emotional attachment. The path between symbolic
brand and sensory experience is significant \( 0.435 \) as is the path between symbolic brand
and emotional attachment \( 0.481 \). Therefore, symbolic brands affect sensory experience and
emotional attachment. Brands with symbolic benefits can express a significant part of the
self-concept. Thus, this result reveals that consumers who satisfied with symbolic brands
are more likely to be connected to a brand. The overall results of this study demonstrate that
the aesthetic, functional and symbolic benefits of brand are all positively related to customer
commitment.

5.3 Customer commitment and brand equity
There are differential effects of sensory experience and emotional attachment on customer
commitment. The direct effect of emotional attachment on commitment \( 0.617 \) is significant.
However, the direct effect of sensory experience on commitment is not significant. Thus,
emotional attachment seems to be a stronger predictor of customer commitment than
sensory experience. This result may be related to the nature of relationship marketing where
sensory experiences are viewed not as objective entities but as subjective symbols
(Hirschman and Holbrook, 1982). Multisensory experiences have never actually occurred,
but are experienced as mental phenomena. Thus, sensory experiences can be combined into
an emotional attachment. If a brand stimulates emotional bonds, then consumers seeking a
connection may be motivated to strive for such strong relationship again. As a result,
emotional attachment is an antecedent of customer commitment.

Finally, the results reveal a significant, direct influence of customer commitment on
brand equity \( 0.084 \). The path empirically demonstrates the important contribution of the
brand benefit to commitment and to brand equity. This result reveals that the one of the
important determinants of brand equity is the commitment to a particular brand. As a
result, the results suggest that if customers are loyal to a brand, then a firm’s brand can
achieve stability and growth of brand-related revenue.

6. Discussion
The important findings from this research are as follows: First, this study found that
emotional attachment was positively and significantly affected by brand benefit including
aesthetic and symbolic brand concepts. Second, this study found that consumers’ emotional
attachment has a positive influence on customer commitment. This result strongly supports
the notion that emotional attachment and commitment are distinct constructs, which
confirms the results of previous research (Malär et al., 2011; Park et al., 2010; Thomson et al.,
2005). Finally, this research suggests that customer commitment affects brand equity
significantly. These findings suggest that aesthetic, functional and symbolic brands are
separate constructs that combine to determine different types of emotional attachment and
commitment related aspects of brand equity.
This conceptualization has been corroborated by our empirical results, in which different outcomes were evident for brand concepts as opposed to brand performance. Functional brand was related to customer commitment, and this was indirectly related brand equity, whereas aesthetic and symbolic brand concepts contributed to both sensory experience and emotional attachment, which in turn contributed significantly to brand equity. From this, it follows that brand equity may be viewed as a link in the path of effects that indirectly connects brand concepts with the market performance aspects of brand equity. Brand concept, emotional attachment and customer commitment are relevant constructs in determining brand equity, which considers commitment or loyalty to be key mediating variables in relational exchanges (Morgan and Hunt, 1994). As contributors to brand concept, emotional attachment and commitment have distinct antecedents.

The results of this research indicate that marketing managers need to consider brands as powerful tools in brand management, more so than previously thought. More specifically, just because consumers can quickly identify a brand based on its characteristics does not mean that they will invest resources towards sustaining their relationship with that brand. Brand characteristics that are easily recognizable, yet which do not convey the brand’s symbolic and functional benefits or do not provide aesthetic gratification, fail to take full advantage of their full potential.

Marketing managers can interpret these results to help justify expenditures on brand strategies that create such long-term relationships with consumers by enhancing emotional attachment and commitment, as these consumer-level constructs contribute to profitable brand equity. Communicating brand positioning to a target consumer has been regarded as an important marketing strategy. Consumers need to feel good about the brand concept and have positive emotional experiences and connections to the brand. A well-communicated brand position should enhance its market performance.

Based on these results, managers may develop differentiated brand concept strategies and tactics. The authors suggest that brand concept in terms of firm manager-selected positioning derived from target consumers’ needs. Thus, managers have the management plan consist of a sequential process of selecting, introducing and elaborating brand concept. Ultimately, the top manager’s goal in managing brand equity is to create a strong relationship between consumer and brand. In simple terms, if manager can build a customer commitment. This will result in the strong brand equity. This brand equity means higher customer retention rates for the manager as well as reduced marketing cost. The result is increased marketing profitability.

Presently, marketplace is very complex, and brands must be positioned particularly clearly. This study demonstrates that focusing on the brand management provides marketers with a valuable, largely untapped tool in their efforts to deepen customer–brand relationships and enhance brand equity.

Despite its meaningful findings, this study has some limitations. First, this study does not investigate the moderating role of other possible influential variables such as brandschematicity. Puligadda et al. (2012) suggested that brand-schematic consumers organize and interpret brand information at the level of the brand. Therefore, they have easy access to brand information in their memories. A brand-schematic consumer should pay more attention to brand information than a brand-aschematic consumer (Keller, 1993). Therefore, they are more like to evaluate a particular brand better, unless brand-schematicity is controlled. Future research could examine the moderating role of brand-schematicity. Second, it would be interesting to investigate the effect of consistency between brand concept and product category on a brands’ evaluation. Brand concept taps brand-related information, while product category refers to product attribute information. It is possible
that in an evaluation of a brand that inconsistency between brand concept and product category results in a lower evaluation of the customer–brand relationship. Finally, author does not distinguish between corporate and product brands, which can interact with commitment and impact brand equity. Future research could explore how corporate and product brands influence brand equity over time.

Note
1. Assistant Professor, Department of Business Administration, Anyang University, 22 Samdeok-ro 37beon-gil, Manan-gu, Anayang-si, Gyeonggi-Do, Korea. Tel: +82-10-8863-8533, E-mail: eric@anyang.ac.kr

References


## Appendix

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Scale items</th>
<th>Sources</th>
</tr>
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<tbody>
<tr>
<td>Aesthetic benefit</td>
<td>[Brand name]'s logo is aesthetically (visually) pleasing to me</td>
<td>Park et al. (2013)</td>
</tr>
<tr>
<td></td>
<td>[Brand name]'s logo provides aesthetic pleasure to me</td>
<td></td>
</tr>
<tr>
<td>Functional benefit</td>
<td>[Brand name]'s logo represents the functional benefits I can expect from the brand</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[Brand name]'s logo ensures me that the brand assists me in handling my daily life competently</td>
<td></td>
</tr>
<tr>
<td>Symbolic benefit</td>
<td>[Brand name]'s logo makes me think that [brand name] expresses who I am as a person</td>
<td>Brakus et al. (2009)</td>
</tr>
<tr>
<td></td>
<td>[Brand name]'s logo makes me think that [brand name] makes my life richer and more meaningful</td>
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<td>Sensory experience</td>
<td>This brand makes a strong impression on my visual sense or other senses</td>
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<tr>
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<td>This brand does not appeal to my senses</td>
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<td>Emotional attachment</td>
<td>My feelings toward the brand can be characterized by affection</td>
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<td>My feelings toward the brand can be characterized by passion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>My feelings toward the brand can be characterized by connection</td>
<td></td>
</tr>
<tr>
<td>Commitment</td>
<td>I feel loyal towards [brand name]</td>
<td>Park et al. (2013)</td>
</tr>
<tr>
<td></td>
<td>Even if [brand name] would be more difficult to buy, I would still keep buying it</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I am willing to go the extra mile to remain a customer of [brand name]</td>
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</tr>
</tbody>
</table>

Table AI. Construct items

## Impact of brand concept

245
Challenges and factors influencing initial trust and behavioral intention to use mobile banking services in the Philippines

Jason Lim Chiu and Nelson C. Bool
The Graduate School, University of Santo Tomas, Manila, Philippines, and

Candy Lim Chiu
College of Business and Public Management, Wenzhou-Kean University, Wenzhou, China

Abstract
Purpose – This paper aims to assess the direct effects of antecedents of initial trust, the mediating effect of trust and the moderating effect of demographic variables on non-adopters' behavioral intention to use mobile banking.

Design/methodology/approach – The study tested the models of theory of reasoned action and theory of planned behavior to evaluate potential antecedents of trust (diffusion of trust, infrastructure quality, perceived costs, privacy and security) moderators (demographic variables) and mediators (initial trust) that will influence behavioral intention to use mobile banking. The Hayes’ Process Macro developed by Andrew F. Hayes (2013) was used as a statistical analysis in SPSS to estimates the path coefficients using multiple regression. The tool provides insights on the direct and indirect effect of the independent variable on the dependent variable through the existence of moderating variables and mediation variables.

Findings – The results show that the non-adopters of mobile banking asserted that the antecedents of initial trust played a significant influence on behavioral intention to use online banking services.

Originality/value – There is a dearth of literature addressing mobile banking in the Philippines. The first initial trust formation in internet banking using computer workstations and laptops in the Philippines was conducted by Chiu et al. (2016). This research fills in the gap by expanding and formulating a deeper understanding of the antecedents of initial trust that influence consumer behavioral intention that might be responsible for the slow diffusion of mobile banking services in the country. The results from this study will help financial institutions create a beneficial connection with consumers while alleviating the fears of non-adopters and enhancing their understanding of the benefits of mobile banking.

Keywords Philippines, Behavioral intention, Online banking, Mobile banking, Antecedents of trust, Initial trust

Paper type Research paper
1. Introduction

The Philippines financial system is undergoing a period of technological innovations. The changes include a significant increase in the number of alternative formal channels for delivering financial services. The most recent are the use of mobile banking. Since the telecommunication industry was liberalized from 65 years of private monopoly ownership in 1992, there is a rapid growth in cellular mobile telephone services in the country. By the year 2000, the mobile phone subscriptions surpassed fixed telephone lines with a ratio of 8.3:3.9 per 100 subscriptions (ITU, 2016). At the end of 2012, it indicates that every Filipino owned a mobile phone regardless of economic status with 101.9 million subscribers exceeding the total population of the country of 97.1 million. The deficiencies of fixed telephone lines in underserved and unserved areas facilitated the adoption of mobile devices and short message services (SMS). Therefore, financial institutions are attracted to reach larger population by utilizing mobile phones to bring financial services to undertake banking transactions such as account balance inquiries, monitor checking account transactions, pay utility bills, pay loans, fund transfer, receive and send remittances and payroll services. It is important distribution channels through which bank customers can be migrated from brick-and-mortar branches to minimize banks' operating expenses (Peever et al., 2008).

Despite the rapid rollout of mobile services and popularity of mobile money in the country, adoption of mobile banking has been slow. Based on the study of Ramanathan et al. (2014) on digital banking penetration across 13 Asian markets, they found that the Philippines had the lowest digital banking penetration which shows only 9 per cent of the respondents used a smartphone to transact banking services. However, despite the Philippines earned the title of “texting capital of the world” or the “SMS-intensive country in the world” (GSMA, 2014), the use of mobile phones in online banking services is still in its infancy stage, and the mobile money services provided by telecommunication industry retains its position as the leading mobile financial channel for the Filipino. There is a dearth of literature addressing mobile banking, prior researches focused on microfinance services (Jimenez and Roman, 2005), ease of use of internet banking (Lim, 2013), mobile money (Alampay and Bala, 2010; Boor et al., 2014; Mendes et al., 2007) and internet banking (Chiu et al., 2016).

This research fills in the gap by expanding and formulating a deeper understanding of the antecedents of initial trust that influence consumer behavioral intention that might be responsible for the slow diffusion of mobile banking services in the country. This study focuses on analyzing the direct effects of antecedents of trust, the mediating effect of initial trust and the moderating effect of demographic variables on non-adopters’ behavioral intention to use mobile banking. The results from this study will help financial institutions create a beneficial connection with consumers while alleviating the fears of non-adopters. It will also enhance their marketing efforts on the benefits of mobile banking by knowing the different factors that influence trust toward the use of mobile banking. This paper has been structured as follows: Section 2 provides a literature review of the mobile banking and barriers to adoption in the Philippines. Section 3 outlines theoretical framework, conceptual model and hypothesis development. Section 4 highlights the research methodology. The results and discussion are presented in Section 5. Lastly, Section 6 discusses the key conclusion, significant business implications, research limitations and future research directions.

2. Literature review

Mobile phones have increasingly become a significant tool that an individual use for banking, budgeting, payments and shopping. Given the rapid growth in the area of mobile
finance, mobile banking has been a major contributor to the evolution of banking system. The purpose of mobile banking is to increase bank's profitability (DeYoung et al., 2007; Hernando and Nieto, 2007) by reaching a wider geographical area (Cruz et al., 2010) and decreasing bank's operating costs such as handling fees, transaction costs, manpower and overhead expenses (Nsouli and Schaechter, 2002; Polatoglu and Ekin, 2001). Convenience and efficiency of mobile banking within the overall service delivery process provide consumer value by decreasing time, effort and costs (Laukkanen and Lauronen, 2005).

Table I presents the different mobile banking services provided by the local banks in the Philippines which aim to give freedom to carry out most of the physical banking activities. Based on Digital Report end of 2016 on Southeast Asia (We Are Social and Hootsuite, 2017), it shows that Philippines are advancing in digital connectivity:

- Philippine population having mobile subscriptions is 128 per cent.
- Population using the internet is 58 per cent.
- Population using mobile phones is 88 per cent.
- Population using smartphones is 61 per cent.
- Active mobile internet users constitute to 51 per cent.
- Lastly, 30 per cent are mobile banking users.

Despite that there are 148.71 mobile-cellular telephone subscriptions per 100 Filipinos in the country (ITU, 2016), as well as banks expansion and innovations through online banking, the use of mobile banking in the Philippines has not reached a level of growth. The Philippines, an archipelago of over 7,000 islands, access to financial services in remote areas and islands are mostly operated in cash or over-the-counter exchanges, who are alienated with the newest advances in technology. Some do not see the value such as small business owners, farmers and fishermen, others are illiterate in using the internet and many are poor. This population was reluctant to risk everything from financial loss by using new financial innovations. Based on the following research studies on Philippine internet environment (Akamai Technologies, 2016; Bangko Sentral ng Pilipinas (BSP), 2015; Lee and Jaramillo, 2013; ITU and UNESCO, 2015; Alegado and Yap, 2016; Huddleston, 2015; House of Representative, 2015, 2016; Avendano, 2013; Felipe, 2014; Symantec, 2016), there are four barriers to diffusion of online banking, namely, infrastructures, costs, privacy and security, that this study adopted to test their real effect on behavioral intention of customers to adopt mobile banking services in the Philippines which are crucial factors for individual participation in modern technological.

2.1 Infrastructure

Internet speed is a major source of daily frustration of internet users in the country. Many cities in the rural areas require massive investment to move up to a more advanced internet connection. Based on Akamai Q4 report (2016), the global average internet speed is 5.6 Mbps. However, the country has an average speed of 3.5 to 4.5 Mbps which is below the global standard. It also shows that Philippine ranked 108th out of 146 countries studied. The country has been consistently ranked at the bottom when it comes to internet speed among Asia-Pacific countries, whereas other neighboring states continue to improve its internet infrastructures. For example, Singapore average speed leapfrog from 16.5 to 20.2 Mbps, Thailand jumped from 10.8 to 13.3 Mbps, Vietnam from 5.0 to 8.3 Mbps, Malaysia from 6.4 to 8.2 Mbps and Indonesia from 4.5 to 6.7 Mbps. The country is still lagging behind among ASEAN countries when it comes to broadband adoption from per cent above 4, 10 and 15.
<table>
<thead>
<tr>
<th>No.</th>
<th>Institutions</th>
<th>Internet banking name</th>
<th>1 Access and manage account</th>
<th>2 Local fund transfer</th>
<th>3 Bills payment</th>
<th>4 E-Shop</th>
<th>5 Credit card</th>
<th>6 Check account status</th>
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<th>10 Loans services</th>
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<th>13 Security seal</th>
<th>14 Mobile app</th>
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Table I. Summary of commercial and universal banks' mobile banking services as of February 2017
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<tr>
<td>20</td>
<td>Robinsons bank corp.</td>
<td>Personal banking</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Mbps. With this kind of speed and data limits, users should expect buffering time and hang time if they are going to download, upload and transact online.

There is a significant correlation between internet speed, website download speed, internet usage and user satisfaction (Hoffman and Novak, 1996). An effective and efficient technology-based self-service system such as online banking is dependent on the quality of technological infrastructure such as accessibility, availability, connectivity, navigability, reliability and speed (Al-Somali et al., 2009; Gerrard et al., 2006; Jayawardhena and Foley, 2000; Lee and Turban, 2001; Waite and Harrison, 2004). Critical components such as speed of internet influence frequent connection breakdown, browsing speed, ease of navigation, website transition, waiting time and transaction flow (Poon, 2007). Connection speed was an important attribute linked to the efficiency of mobile fund transfer service and linked to convenience using the mobile brokerage (Laukkonen and Lauronen, 2005).

The importance of quality internet connection influences online-banking acceptance or adoption in Finland (Pikkarainen et al., 2004), Malaysia (Poon, 2007), Saudi Arabia (Almogbil, 2005), Singapore (Gerrard and Cunningham, 2003) and Thailand (Rotcharakhitumnuai and Speece, 2003). In the case of Singapore, Sheshadri and Rani (2014) stated that the Singaporean government plays a major driver for the diffusion of information and communication technology. Based on Sayar and Wolfe (2007, p. 125) research of Turkish internet banking users, speed seekers view download speed, transaction speed, user-friendliness of the site and privacy influence users’ bank selection. Peltier and Youssef (2015) found that speed of internet connection affects consumers’ use of e-commerce in Luxembourg. They investigate the link between demand for internet and e-activities. They found that firms are more likely to undertake e-commerce when the connection speed is higher than 3.75 Mbps and the faster the internet speed, the larger the number of online practices or e-applications adopted. In the case of mobile internet connection, the demand for internet speed is constantly increasing due to the rapid development of mobile devices such as 3G, 4G, 4G+ and mobile applications. Increasing mobile innovations and applications leads to higher internet cost.

2.2 Perceived costs
Affordability of internet connection is a significant factor in influencing internet usage (Hoffman et al., 1999; Venkatesh and Brown, 2001). Perceived costs refer to the person’s believes that using the online banking will cost money (Luarn and Lin, 2005). One-time investment for a mobile device is a necessity in the present world. However, perceived cost has a significantly negative effect on the decision to use mobile commerce (Wu and Wang, 2005) and 3G mobile phones (Kuo and Yen, 2009). Based on the study of Petrazzini and Mugo (1999), the cost and pricing of internet service are broken down into setup costs and operating expenses which is much higher in developing countries than in developed countries. There are also specific regulations or government mandates which influence access and cost of internet. The costs vary depending on the number of Internet Service Providers in the country. Another major consideration is the monthly internet access expenditure which has a bigger slice of a person’s monthly expenses. Based on the study of Martin (2003) on digitally divided society, lower socioeconomic groups would be less likely to use the internet and pay a monthly internet service subscription fees.

United Nations Broadband Commission report (ITU and UNESCO, 2015) shows that only 26.9 of every 100 Filipino homes have access to the broadband internet at 39.7 per cent of individuals using the internet. It also indicates that for every 100 capita, 28 Filipino have a mobile broadband subscription in which the country ranked 103 out of 195 countries studied. Internet access in the Philippines is about US$18 a megabit per second more than three times the global average internet costs of US$5 (Alegado and Yap, 2016; Huddleston, 2015). In
comparison with monthly internet broadband subscription costs in Singapore, the Philippines is rated two to three times higher. For example, in Singapore, 100 Mbps costs US$28, 200 costs US$30 and 500 costs US$43, whereas in the Philippines, 100 Mbps costs US$70, 200 costs US$90 and 500 costs US$150 a month (House of Representative, 2015, 2016). Kim et al. (2007) stated that customers would compare the fee structure of the mobile internet, mobile phone calls and stationary internet access. For an average Filipino family with an average annual income of US$4,700-5,000 and an average annual expenditure of US$3,860, giving them a savings amounting to US$840, it will be very difficult for them to afford the internet service.

The cost associated with internet access fees and subscription charges is a significant barrier to the adoption of internet banking (Poon, 2007; Sohail and Shanmugham, 2003; Zheng and Zhong, 2005). Perceived costs discourage non-users from using the internet banking services because they feel that it would entail more costs than the relative advantage (Kuisma et al., 2007; Sathye, 1999). It also has a negative influence on the behavioral intention to use mobile banking in Australia (Wessels and Drennan, 2010), Brazil (Cruz et al., 2010) and Taiwan (Luarn and Lin, 2005; Yu, 2012). It is, therefore, hypothesized that financial considerations, including the cost of a web-enabled mobile phone and subscription fees, will influence consumer intentions to use mobile banking.

2.3 Online privacy

Privacy and security are associated with financial risks (Cheng et al., 2006). Both factors are major concerns of trust (Bidarra et al., 2013; Susanto et al., 2012; Susanto et al., 2016; Wang and Shan, 2013) and are considered obstacles to the adoption of mobile commerce (Gao and Bai, 2014). In the banking context, privacy refers to the ability of the bank to authenticate and protect consumers’ personal information from unauthorized access which is free from invasion, interception and theft (Cheung and Lee, 2001; Mukherjee and Nath, 2003; Lee, 2009; Lee and Turban, 2001; Littler and Melanthiou, 2006; McKnight et al., 2002). It follows legal and ethical practices such as Federal legislation that prevents corporation and government manipulation of personal information (Agranoff, 1991; Casaló et al., 2007). Feakin et al. (2015) developed a “cyber engagement scale” with indicators of governance, crime, military, business and social for government and industry to measure countries cyber maturity. “Maturity is demonstrated by the presence, effective implementation, and operation of cyber-related structures” (Feakin et al., 2015, p. 5). They found that the Philippines continues to suffer from passive government engagement, weak enforcement, lack of awareness of cyber military issues and lack of strategic public policy and engagement with the industries and private sectors on the development of the digital economy.

With these weaknesses, the country has experienced sophisticated cyber-attacks from virus-infected e-mails, malware, website attacks, money laundering and fraudulent activities. Based on the report of Department of Justice (DOJ), “87 per cent of Filipino internet users were identified as victims of crimes and malicious activities committed online” (Avendano, 2013). According to Philippine National Police, internet fraud tops the list of cybercrime from 2010 to 2013 (Felipe, 2014). Major incidents of cybercrime in the Philippines include the “I Love You” virus in 2000, hacking into government websites in 2004, the “Heartbleed Bug” in 2014, hacking into Commission on Election (Comelec) website in 2016 and the Bangladesh Central Bank cyberheist in 2016.

2.4 Online security

Based on the three decades of research on consumer adoption and utilization of electronic banking by Hoehle et al. (2012), there are 63 studies out of 247 peer-reviewed articles stating that security was a major factor influencing consumers’ intentions to use the electronic
banking system. The perspective of security is that online financial transaction is dangerous (Goudarzi et al., 2013). Consumer awareness of security practices such as authentication, biometrics, callback modems, encryption, digital certificates, firewalls, filtering routers, password protection, PC hardware security and smart cards would increase customer confidence in using online banking services (Yousafzai et al., 2003). Grandinetti (1996) defined security as protection of data from unauthorized individuals, whereas Casaló et al. (2007) defined security as the technical guarantee that legal and ethical practices are met. Aladwani (2001) and Jun and Cai (2001) found that IT managers and customers were more concerned with the security of online banking due to the absence of personal interaction than they were with traditional banking. Laukkonen (2007) finds that safety is one of the key factors in determining consumer value perception of internet banking and mobile banking. The study of Susanto et al. (2016) confirms that security significantly influence trust on smartphone banking services.

The Internet Security Threat Report by Symantec (2016) shows that retail industry was the most heavily exposed to phishing attacks in 2015. Under the retail industry, the finance sector was the most targeted by spear-phishing attacks with 34.9 per cent of all spear-phishing e-mail directed to a very small group of people in an organization in the Finance industry, which is 15 per cent higher than 2014. The ratio 1 out of 2,200 users is a victim of e-mail phishing, and the ration 1 out of 310 is a victim of Malware in an e-mail. The industry also ranked second regarding data breached with 120 million identities exposed in 2015. Common cybercrimes, phishing and pharming, occur when falsified bank website asks consumers to provide their personal identification number, password and transaction number; the unauthorized person uses this confidential information later to operate fraudulent financial activities. If bank consumers perceive that mobile banking is secured and has privacy protection, then it may lead to positive perception in determining attitudes toward the use of mobile services (Lin, 2011).

3. Theoretical framework

3.1 Theory of reasoned action and theory of planned behavior
According to theory of reasoned action (TRA), behavioral intention is the cognitive representation of individual readiness to perform a given behavior shaped by person’s attitude and affected by the subjective norm (Fishbein and Ajzen, 1975). Attitude is a beneficial factor in which behavior is either positive or negative. Subjective norm is how a person’s perceptions are influenced by society. Sheppard et al. (1988) pointed that specificity, actions, timing, context and target are the key to distinguishing the attitude, intention and behavior. Ajzen (1991) introduced the theory of planned behavior (TPB) as the extension of the TRA that further explains adoption behavior. It focuses on behavioral intention being a function of attitude, subjective norms and perceived behavioral control (Fishbein and Ajzen, 1975; Taylor and Todd, 1995). In his first attempt, he found out that attitude and subjective norm could not fully determine behavioral intention. So he expanded the model by adding perceived behavioral control in determining human behavior.

Ajzen (1991) explained that the TPB describes how an individual is likely to perform a behavior that leads to the determinant of the individual’s actual behavior. There are three variables that influence individual behavioral intention: attitude toward the behavior that refers to an individual’s beliefs that an individual participation will help to achieve desired goals (e.g. trust, practicality, sense of being in a community, convenience, monetary benefits and environmental concern). Subjective norms refer to the person who influences the decision and participation (e.g. family and friends). And perceived behavioral control reflects the person’s perception of ease or difficulty of performing a given behavior with the
presence of control factors (e.g. self-efficacy, perceived privacy protection and technology facilitating condition). TPB assists individuals in making decisions rationally and systematically by the information available to them. Table II presented some of the studies that applied either the TRA or TPB on internet banking (Suh and Han, 2002; Yousaalzai et al., 2009) and mobile banking (Gu et al., 2009; Zhou, 2012; Maroofi et al., 2013), whereas some scholars such as Alsajjan and Dennis (2010) combined these models in predicting attitudinal intention to use internet banking.

McKnight et al. (1998, 2002, p. 301) define behavioral intentions in terms of consumer projection, anticipation, intention and willingness as a trust construct to perform three specific behaviors:

1. follow the advice of the web vendor;
2. share personal information with the vendor; and
3. purchase goods or services from the vendor.

They stated that these three behavioral intentions are the outcomes of trust which would become trust-related behaviors. Trust increases over time, as it accumulates through stages and influences behavioral intention to actual use (Pavlou, 2003).

3.2 Initial trust

Given trust as the central determinant of relationships, an individual perceives the other party is trustworthy. It is a volitional vulnerability that influences an individual to such interaction to commit to the relationship (Holmes, 1991; Mayer et al., 1995). Before an individual commits in interaction and relationship, the level of trust starts at zero (Lewicki et al., 2006). McKnight et al. (1998) argue that consumers go through stages of trust in deciding whether or not to explore or to transact with an online business. Initial trust is the introductory stage, where there is presence of fear and unfamiliarity when customer lacks first-hand knowledge, credible information and experience (McKnight and Chervany, 2001/2002, 2006; McKnight et al., 1998; McKnight et al., 2002; McKnight et al., 2003/2004).

McKnight et al. (2003/2004) further proposed a model of initial trust formation that consumers go through in deciding whether or not to explore or transact with an online business. They argue that an early stage of consumer trust is divided into two sub-stages (2003-2004, pp. 2-3):

1. Introductory stage or stage of unfamiliarity is a stage in which a consumer has not yet experienced the website and has only second-hand or non-experiential information about the site through browsing, searches, advertisement and from others’ feedback. A consumer must choose whether or not to explore a site he/she may have heard. So when the consumer decides to use the site, he/she already enters the next stage.

2. Exploratory stage is the stage when the consumer first visits the site and then decides whether or not to transact, provide personal information or rely on the web business.

Potential users make initial judgments about the online service or technology that could determine whether or not they will use the mobile banking in the future. Initial trust has the willingness to depend on factors that make an individual accept the risk and uncertainty of transacting business (Lowry et al., 2008; Hampton-Sosa and Koufaris, 2005). Thus, banks need to gain sufficient trust at this first stage to overcome consumers’ perceptions of risk and to persuade customers to transact with them which is particularly critical to the success
<table>
<thead>
<tr>
<th>Author/s</th>
<th>Respondents</th>
<th>Measurement</th>
<th>Theories</th>
<th>Consequences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suh and Han (2002)</td>
<td>845 – IB users – South Korea</td>
<td>SEM</td>
<td>TRA, TAM</td>
<td>Trust had a significant positive impact on behavioral intention on IB</td>
</tr>
<tr>
<td>Gu et al. (2009)</td>
<td>910 – MB users – South Korea</td>
<td>SEM</td>
<td>TAM, TRA</td>
<td>Trust is crucial in increasing behavioral intention to use MB</td>
</tr>
<tr>
<td>Liu et al. (2009)</td>
<td>438 – MB users – China</td>
<td>SEM</td>
<td>TAM</td>
<td>Intention is directly affected by trust in MB</td>
</tr>
<tr>
<td>Youssafzai et al. (2009)</td>
<td>441 – IB users – Scotland</td>
<td>SEM</td>
<td>TPB</td>
<td>Trust has a direct effect on intentions to use IB</td>
</tr>
<tr>
<td>Alsajjan and Dennis (2010)</td>
<td>Undergraduate – 232 UK and 386 Saudi Arabia</td>
<td>SEM</td>
<td>TAM, TRA, TPB</td>
<td>Results confirm that intentions toward IB adoption are attitudinal</td>
</tr>
<tr>
<td>Dimitriadis and Kyrezis (2010)</td>
<td>762 – bank customers – Greece</td>
<td>SEM</td>
<td>TAM</td>
<td>Trust has a strong mediating role of trusting intention on the intention to use IB</td>
</tr>
<tr>
<td>Kim and Kang (2012)</td>
<td>247 – IB users – South Korea n = 251 – bank customers – Indonesia</td>
<td>Path analysis Partial least squares regression</td>
<td>TAM Initial Trust Formation</td>
<td>Trust is a significant factor affecting the intention to use MB Initial trust has a partial mediating role between the antecedents and usage intention of IB</td>
</tr>
<tr>
<td>Susanto et al. (2012)</td>
<td>200 – mobile consumers – Indonesia</td>
<td>FA and SEM Partial least squares regression</td>
<td>TRA Self-Determination theory Deci and Ryan’s and TAM</td>
<td>Trust has a significant effect on flow experience and usage intention of MB Intrinsic motivation is responsible for building user’s trust in the intention to use IB</td>
</tr>
<tr>
<td>Maroofi et al. (2013)</td>
<td>n = 210 – bank customer – Iran</td>
<td>SEM</td>
<td>TRA</td>
<td>Initial trust positively affects usage intention of MB</td>
</tr>
<tr>
<td>Oliveira et al. (2014)</td>
<td>n = 284 – public university – Portugal</td>
<td>SEM</td>
<td>TTF and UTAUT</td>
<td>Initial trust has total effect on the behavioral intention on MB</td>
</tr>
<tr>
<td>Afshan and Sharif (2016)</td>
<td>n = 198 – higher education students – Pakistan</td>
<td>FA and SEM</td>
<td>TTF and UTAUT</td>
<td>There is significant association of initial trust with the intention to adopt MB</td>
</tr>
<tr>
<td>Chaouali et al. (2016)</td>
<td>245 – undergraduate – Tunisia</td>
<td>PLS</td>
<td>UTAUT</td>
<td>Trust in the IB services has a positive impact on customers’ intention to adopt IB</td>
</tr>
</tbody>
</table>

**Note:** Structural equation modelling (SEM); Factor analysis (FA); Task-technology fit (TTF); unified theory of acceptance and usage of technology (UTAUT)
of online banking. Table II presented that multiple studies have found that initial trust serves as a mediating variable (MeV) between antecedents and behavioral intention.

3.3 Disposition to trust
The initial trust-building model by McKnight and his group of researchers shows that disposition to trust as the origin of individual’s trust comes from the psychological trait of a person. The person’s actions are “molded certain childhood derived attributes that become more or less stable over time” (McKnight and Chervany, 2001/2002, p. 41). They considered it as cross-situation and cross-personal because of the presence of propensity to rely on web business in the absence of specific knowledge and experience. Disposition to trust is most influential when the relationship between the trustor and trustee is new which is similar with initial trust when trustor is unfamiliar with the trustee (McKnight et al., 1998; Rotter, 1980). Gefen (2000) and Chen and Barnes (2007) found that people’s disposition to trust affected their initial trust in e-commerce vendor. Moreover, this stage fades when the consumer gains experience and forms gradual trust (McKnight and Chervany, 2001/2002; Gefen, 2000).

There are two divisions of disposition to trust (McKnight and Chervany, 2006): faith in humanity and trusting stance. First, faith in humanity means that a person assumes that others care enough to help other people. Those with high faith in humanity tend to be less judgmental, critical or more tolerant of others’ mistakes. Moreover, second, the trusting stance is a personal choice or strategy that a person assumes about the other people that derive from the calculative-based trust. A person subjectively calculates the possible benefits gained and is willing to take the risk to perform unless negative experience takes place to force him/her to change his/her mind. Consequently, individual with a high disposition to trust are more inclined to interact in a more positive manner with an unfamiliar website until the website, or online vendor proves to be untrustworthy (Wu et al., 2010). Disposition to trust was significant predictors of initial trust in internet banking (Grabner-Kräuter and Faullant, 2008; Kim and Prabhakar, 2004; Kim et al., 2009) and mobile banking (Zhou, 2011).

3.4 Demographic profile as moderating variables
Some scholars in online banking prove that demographic profiles are statistically significant toward the adoption of new technology-based services. Gender and age are the most studied demographic characteristics in the online banking context. For example, when compared to women, men are task-oriented and more receptive to technological innovations such as mobile banking services (Cruz et al., 2010; Laforet and Li, 2005; Laukkonen and Pasanen, 2008; Laukkonen, 2016; Suoranta and Mattila, 2004). As an individual’s age increases, the adoption probability decreases. Older customers have a lower propensity, negative attitude and are more resistant to change toward using mobile banking services (Cruz et al., 2010; Fall et al., 2015; Laforet and Li, 2005; Laukkonen et al., 2007; Laukkonen, 2016). Based on the study of Joshua and Kosby (2011), younger generations are the typical users of online banking.

Marital status, level of education and household income have been pointed to have a positive impact on the adoption of online banking services. Some authors argue that marital status was significantly associated with the adoption of mobile communications (Munnukka, 2007) and mobile banking (Iddris, 2013). Individuals with a higher level of educations have access to technology and the internet are more comfortable in using self-service technologies given that they have greater internet literacy and self-efficacy (Karjaluoto et al., 2002; Mattila et al., 2003; Meuter et al., 2005). Income and wealth influence the use of internet (Porter and Donthu, 2006) and online banking system (Mann and Sahni, 2012).
4. Conceptual framework and hypothesis formulation

This study intends to investigate the perceived impact of mediation and moderating variables (MoV) to behavioral intention to use mobile banking services. Based on the above review of literature and their prior research results, we proposed a conceptual model (Figure 1) to explain non-adopters’ behavioral intention to use mobile banking by synthesizing both positive and negative factors through the adoption of TRA and TPB.

Based on previous studies, this research tested a model of behavioral intention to evaluate potential moderators and mediators of the relationship as presented in Figure 1 assuming that the factors influence the intention to adopt mobile banking:

- **Disposition to trust** (Grabner-Kräuter and Faullant, 2008; Kim and Prabhakar, 2004; Kim et al., 2009; Zhou, 2011): We can infer that disposition to trust would have a significant effect on consumers’ initial trust toward the intention to use mobile banking. Thus, we propose that:

  \[ H1c. \text{Disposition to trust significantly influences behavioral intention to use mobile banking.} \]

  \[ H1a. \text{Disposition to trust significantly influences customer’s initial trust.} \]

  \[ H1b. \text{Customer’s initial trust significantly influences behavioral intention in disposition to trust path.} \]

  \[ H1c’. \text{The relationship between the disposition to trust and behavioral intention to use mobile banking is fully mediated by initial trust.} \]

- **Infrastructure quality** (Almogbil, 2005; Gerrard and Cunningham, 2003; Pikkarainen et al., 2004; Poon, 2007; Rotchanakitumnuai and Speece, 2003): We hypothesized that slow internet connection speed in the Philippines may make banking customers uncertain about whether or not to adopt mobile banking:

  \[ \text{Effect IV on MeV} = \alpha \text{ path} \]

  \[ \text{Direct effect} = c’ \text{ path} \]

  \[ \text{Effect MeV on DV} = b \text{ path} \]

  \[ \text{Interactive effect of IV and MoV on c path} = d \text{ path} \]

  \[ \text{Total effect} = c \text{ path} \]

**Figure 1.** Conceptual model – the hypothesized moderator and mediation model
**H2c.** Infrastructure quality significantly influences behavioral intention to use mobile banking.

**H2a.** Infrastructure quality significantly influences customer’s initial trust.

**H2b.** Customer’s initial trust significantly influences behavioral intention in infrastructure quality path.

**H2c’.** The relationship between infrastructure quality and behavioral intention to use mobile banking is fully mediated by initial trust.

- **Perceived costs** (Cruz et al., 2010; Kuisma et al., 2007; Luarn and Lin, 2005; Poon, 2007; Sathye, 1999; Sohail and Shanmugham, 2003; Wessels and Drennan, 2010; Yu, 2012; Zhengh and Zhong, 2005): It is therefore hypothesized that financial considerations, including the cost of a web-enabled mobile phone and subscription fees, will influence consumer intentions to use mobile banking:

**H3c.** Perceived costs significantly influence behavioral intention to use mobile banking.

**H3a.** Perceived costs significantly influence customer’s initial trust.

**H3b.** Customer’s initial trust significantly influences behavioral intention in perceived costs path.

**H3c’.** The relationship between perceived costs and behavioral intention to use mobile banking is fully mediated by initial trust.

- **Privacy** (Cheung and Lee, 2001; Mukherjee and Nath, 2003; Lee, 2009; Lee and Turban, 2001; Littler and Melanthiou, 2006; McKnight et al., 2002): If bank consumers perceive that mobile banking is secured and has privacy protection, then it may lead to positive perception in determining attitudes toward the use of mobile services (Lin, 2011). So the following hypothesis is formulated:

**H4c.** Privacy significantly influences behavioral intention to use mobile banking.

**H4a.** Privacy significantly influences customer’s initial trust.

**H4b.** Customer’s initial trust significantly influences behavioral intention in privacy path.

**H4c’.** The relationship between privacy and behavioral intention to use mobile banking is fully mediated by initial trust.

- **Security** (Casaló et al., 2007; Goudarzi et al., 2013; Laukkanen, 2007; Lin, 2011; Yousafzai et al., 2003; Susanto et al., 2016): These studies confirmed that security significantly influences trust; thus, the following hypotheses are proposed for investigation:

**H5c.** Security significantly influences behavioral intention to use mobile banking.

**H5a.** Security significantly influences customer’s initial trust.

**H5b.** Customer’s initial trust significantly influences behavioral intention in security path.
The relationship between security and behavioral intention to use mobile banking is fully mediated by initial trust.

**Demographics profile:** It includes gender (Cruz et al., 2010; Laforet and Li, 2005; Laukkanen and Pasanen, 2008; Laukkanen, 2016; Suoranta and Mattila, 2004), age (Cruz et al., 2010; Fall et al., 2015; Laforet and Li, 2005; Laukkanen et al., 2007; Laukkanen, 2016), education (Karjaluoto et al., 2002; Mattila et al., 2003; Meuter et al., 2005), income (Mann and Sahni, 2012; Porter and Donthu, 2006) and marital status (Iddris, 2013; Munnukka, 2007); we can hypothesize that demographic variables may moderate the effects of disposition to trust, infrastructure quality, perceived costs, privacy and security on behavioral intention to adopt mobile banking as well as the effects of initial trust on individual behavior of using mobile banking.

**H1d.** The relationship between the disposition to trust and behavioral intention to use mobile banking is fully moderated by demographic profile (gender, age, education, income and marital status).

**H2d.** The relationship between infrastructure quality and behavioral intention to use mobile banking is fully moderated by demographic profile (gender, age, education, income and marital status).

**H3d.** The relationship between perceived costs and behavioral intention to use mobile banking is fully moderated by demographic profile (gender, age, education, income and marital status).

**H4d.** The relationship between privacy and behavioral intention to use mobile banking is fully moderated by demographic profile (gender, age, education, income and marital status).

**H5d.** The relationship between security and behavioral intention to use mobile banking is fully moderated by demographic profile (gender, age, education, income and marital status).

The conceptual framework is patterned on the proposed model of Baron and Kenny (1986) on assessing the presence and effect of MeV and MoV on the strength and direction of the relation between an independent variable (IV) and a dependent variable (DV). The difference between moderator-predictor relation and mediator-predictor relation is that the variables of the former are at the same level in relations to their role as exogenous to certain criterion effects which mean moderator variables also function as an IV. While the later relations show that the predictor is commonly the antecedent to the mediator where the mediator can shift roles from effects to causes.

**4.1 Mediation analysis**

Based on the proposed model of Baron and Kenny (1986) for assessing the presence of a mediating effect, there are several path-analytic regressions were conducted to describe the entire structure of cause and effect linkages of all paths. It determined the magnitude of direct and indirect influences that each variable has on the other variables. Figure 2 shows Baron and Kenny (1986) mediations effect using the four steps process interpreted using multiple regression analysis:
Step 1. Path c: IV as predictor and the DV as the outcome variable — this step establishes that there is a significant effect that may be mediated.

Step 2. Path a: This confirms the significance of the relationship between the IV and the MeV — mediator is outcome variable.

Step 3. Path b: It shows that the MeV affects the outcome variable (DV). This study assumed that there are significant relationships from Steps 1 to 3, and we can make an assumption that Step 4 or mediation effect is possible.

Step 4. Path c': MeV and IV are used simultaneously to predict the DV where MeV completely mediates the IV–DV relationship.

4.2 Moderation analysis
Baron and Kenny (1986, p. 1174) define a moderator “as a qualitative (e.g. race, sex, class) or quantitative (e.g. level of reward) variable that affects the direction and/or strength of the relation between an independent or predictor variable and a dependent or criterion variable”. Moderation analysis indicate when or under what conditions a particular association can be expected. Based on the proposed moderation analysis model of Baron and Kenny (1986), there are three causal paths that influence the outcome or the DV as presented in Figure 3. It shows that the slope and intercept of the regression of DV on IV depends on the specific value of MoV:

1. the impact of IV as predictor: Path a;
2. the impact of the MoV: Path b; and
3. the interaction of predictor (IV) and moderating (MoV): Path c.

5. Research methodology
The data were collected from both qualitative and quantitative method. The questionnaire was the main data-gathering instrument used in this study and supplemented by informal
interviews. Selected factors found in the questionnaires were based on previously reviewed studies. To provide more reliable and valid results, a pre-testing of the questionnaires was done with customers from the twenty local banks. As the result of the pre-test, several items were refined. There were changes made in the formulation of proper wording and meaning to be adopted. Some initial items were found to be unclear for the respondents, and these items were eliminated. After the pre-test, the original questionnaire were refined. In all, 46 questions regarding non-adopters of mobile banking were developed. All variables were measured on a five-point Likert scale which ranges from strongly disagree (1) to strongly agree (5).

5.1 Sampling method
The samples were taken from Manila City and Makati City as the financial districts of the Philippines. These cities are the main areas in the country where internet penetration are higher, and internet connectivity is developed. The self-administered method was used to gather data from various bank customers from July 2016 until October 2016. All respondents are clients who have bank accounts in the local banks in the country. The researchers’ implicit assumption is that these clients who are non-adopters of mobile banking can be potential adopters of online services in the future.

Based on the study of Green (1991) on how many subjects does it take to do a regression analysis, the general rule of thumb is no less than 50 respondents for a correlation or regression analysis with the number increasing based on the number of IVs or predictors of DVs. Green (1991) suggests $N > 50 + 8p$ (where $p$ is the number of IVs) in considering the multiple $R^2$ values or $N > 104 + p$ in considering the beta weights for testing the multiple correlation or regressions. The calculations of the sample size are presented in Table III.

A total of 500 questionnaires beyond the minimum sampling size based on Green (1991) model were sent to non-adopter respondents. Also, 314 surveys were returned at the end of data collection process. Table IV provides the profile of the non-adopter respondents and their internet and mobile use. The qualitative method explains the perception of non-adopters of mobile banking and identifies some factors that affect initial trust and behavioral intention to use mobile banking as shown in Table V. This method helps identify possible factors not captured by previous studies.

6. Results and discussion
In this research, the impact of key IVs that could influence initial customer trust in mobile banking and behavioral intention was tested. Some of the key findings from the data analysis are highlighted below.

6.1 Validity and reliability
Reliability analysis was carried using internal consistency measure of Cronbach’s alpha. Results show all variables have a high-reliability range from 0.702 to 0.877 which exceeded the minimum acceptable value of alpha = 0.7 as presented in Table VI. Nunnally (1978) stated that the closer the value of alpha to 1, the higher the internal consistency and reliability of the instrument. Also, Ferketich (1991) stated that corrected item-total

<table>
<thead>
<tr>
<th>Green (1991) Model</th>
<th>Non-adopter(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(based on multiple $R^2$) $N &gt; 50 + 8p$</td>
<td>$N &gt; 50 + 8(11) = 138$</td>
</tr>
<tr>
<td>(based on beta weights) $N &gt; 104 + p$</td>
<td>$N &gt; 104 + 11 = 115$</td>
</tr>
</tbody>
</table>
### Table IV.
Profile of respondents

<table>
<thead>
<tr>
<th>Profile</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>124</td>
<td>39.49</td>
</tr>
<tr>
<td>Female</td>
<td>190</td>
<td>60.51</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below 20</td>
<td>41</td>
<td>13.06</td>
</tr>
<tr>
<td>20-25</td>
<td>151</td>
<td>48.09</td>
</tr>
<tr>
<td>26-30</td>
<td>37</td>
<td>11.78</td>
</tr>
<tr>
<td>31-35</td>
<td>44</td>
<td>14.01</td>
</tr>
<tr>
<td>36-40</td>
<td>34</td>
<td>10.83</td>
</tr>
<tr>
<td>Above 40</td>
<td>7</td>
<td>2.23</td>
</tr>
<tr>
<td><strong>Educational level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High school</td>
<td>57</td>
<td>18.15</td>
</tr>
<tr>
<td>Bachelor degree</td>
<td>218</td>
<td>69.43</td>
</tr>
<tr>
<td>Master degree</td>
<td>28</td>
<td>8.92</td>
</tr>
<tr>
<td>Doctoral degree</td>
<td>11</td>
<td>3.5</td>
</tr>
<tr>
<td><strong>Your income per month in US$</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below 200</td>
<td>78</td>
<td>24.84</td>
</tr>
<tr>
<td>200-400</td>
<td>75</td>
<td>23.89</td>
</tr>
<tr>
<td>401-600</td>
<td>77</td>
<td>24.52</td>
</tr>
<tr>
<td>601-800</td>
<td>41</td>
<td>13.06</td>
</tr>
<tr>
<td>801-1,000</td>
<td>30</td>
<td>9.55</td>
</tr>
<tr>
<td>above 1,000</td>
<td>13</td>
<td>4.14</td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>235</td>
<td>74.84</td>
</tr>
<tr>
<td>Married</td>
<td>79</td>
<td>25.16</td>
</tr>
<tr>
<td><strong>How many mobile phones you have?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>146</td>
<td>46.50</td>
</tr>
<tr>
<td>2</td>
<td>142</td>
<td>45.22</td>
</tr>
<tr>
<td>3</td>
<td>22</td>
<td>7.01</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>1.27</td>
</tr>
<tr>
<td><strong>How long have you been using the mobile phone?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than a year</td>
<td>17</td>
<td>5.41</td>
</tr>
<tr>
<td>1-3 years</td>
<td>54</td>
<td>17.20</td>
</tr>
<tr>
<td>4-6 years</td>
<td>67</td>
<td>21.34</td>
</tr>
<tr>
<td>7-9 years</td>
<td>48</td>
<td>15.29</td>
</tr>
<tr>
<td>10 years or more</td>
<td>128</td>
<td>40.76</td>
</tr>
<tr>
<td><strong>On average, how many hours per week do you use the internet on your mobile phone?</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 1 h</td>
<td>9</td>
<td>2.87</td>
</tr>
<tr>
<td>1 to 5 h</td>
<td>61</td>
<td>19.43</td>
</tr>
<tr>
<td>6 to 10 h</td>
<td>108</td>
<td>34.39</td>
</tr>
<tr>
<td>11 to 20 h</td>
<td>71</td>
<td>22.61</td>
</tr>
<tr>
<td>21 to 40 h</td>
<td>43</td>
<td>13.69</td>
</tr>
<tr>
<td>Over 40 h</td>
<td>22</td>
<td>7.01</td>
</tr>
</tbody>
</table>

Note: US$1 = PHP50
correlations should range between 0.30 and 0.70 for a good scale. Therefore, no item was deleted from the variables because it ranges from 0.416 to 0.775, which is within the acceptable value.

Detecting multicollinearity using variance inflation factors (VIF), a VIF measures the extent to which multicollinearity has increased the variance of an estimated coefficient. The general rule of the thumb is that VIF value exceeding 4.00 corresponds to tolerance value of 0.25 (i.e., $1/0.25 = 4$) which warrants further investigation (Rogerson, 2001) and a VIF value of 10.00 corresponds to the tolerance value of 0.10 (i.e., $1/0.10 = 10$); these are signs of serious multicollinearity requiring correction (Hair et al., 1995). Based on the test of multicollinearity

<table>
<thead>
<tr>
<th>Factors</th>
<th>Non-adopters’ opinion toward mobile banking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrastructure quality</td>
<td>The Philippines has one of the slowest internet connections speed in the world same as a data plan&lt;br&gt;Mobile signal is different in every location and places&lt;br&gt;I am already paying the highest monthly fee just to get a better connection, but, still, I faced mobile data connection disruption&lt;br&gt;The higher frequency of application usage and mobile browsing requires more data, faster browsing speeds and better quality service</td>
</tr>
<tr>
<td>Perceived costs</td>
<td>Mobile data plans were costly and only affordable for affluent&lt;br&gt;With the proliferation of smartphones, along with higher mobile app and browsing usage and the 4G network overhauls, mobile operators must prepare for significant increases in big data streams at affordable prices&lt;br&gt;Mobile networks are more focus on social media rather than giving more data network for surfing&lt;br&gt;Monthly internet data connection costs a lot just to use mobile banking. ATMs are accessible everywhere&lt;br&gt;Data allowances advertise by mobile operators are overestimated, resulting in frustrated subscribers who experience overage charges</td>
</tr>
<tr>
<td>Privacy</td>
<td>I am afraid to use the mobile banking because my money online will be stolen without the bank’s knowledge&lt;br&gt;I don’t want to share my personal information online. I want face to face contact with banks' personnel&lt;br&gt;The only thing that goes between you and your money online is your username and password while so I do not think it is safe&lt;br&gt;The banks may not have strict laws regarding data protection</td>
</tr>
<tr>
<td>Security</td>
<td>There is a lot of cyber crimes in the country&lt;br&gt;Money transfer online is not secured, even rich countries, they cannot control hackers&lt;br&gt;I am afraid to share my information may be unauthorized personnel from the bank share it to third parties without bank’s knowledge&lt;br&gt;A number of thefts and pickpockets incident happen in the country, and my mobile phone might steal from me</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variables</th>
<th>No. of items</th>
<th>Cronbach’s alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disposition of trust</td>
<td>6</td>
<td>0.756</td>
</tr>
<tr>
<td>Quality of infrastructure</td>
<td>6</td>
<td>0.789</td>
</tr>
<tr>
<td>Perceived costs</td>
<td>6</td>
<td>0.702</td>
</tr>
<tr>
<td>Perceived privacy</td>
<td>6</td>
<td>0.784</td>
</tr>
<tr>
<td>Perceived security</td>
<td>6</td>
<td>0.823</td>
</tr>
<tr>
<td>Initial trust</td>
<td>5</td>
<td>0.802</td>
</tr>
<tr>
<td>Behavioral intention</td>
<td>9</td>
<td>0.877</td>
</tr>
</tbody>
</table>

Table V. Summary of perception of respondents toward mobile banking

Table VI. Cronbach’s alpha
6.2 Relationships test between the variable
The correlation test was carried out to determine the strength and relationships among the independent, moderating, mediating and DV. As shown in Table VIII, all IV’s positively influence initial trust and behavioral intention to use mobile banking. There is a very strong positive correlation between privacy and behavioral intention ($r = 0.821, p < 0.01$). Disposition to trust ($r = 0.712, p < 0.01$) and security ($r = 0.787, p < 0.01$) shows strong positive correlation with behavioral intentions, whereas perceived costs ($r = 0.463, p < 0.01$) and infrastructure quality ($r = 0.495, p < 0.01$) show moderate correlation with the DV. The results verified a very high significant correlation between initial trust as the MeV and three IVs which included the disposition of trust, privacy and security with a coefficient value range of ($r = 0.749, p < 0.01$) ($r = 0.773, p < 0.01$) and ($r = 0.740, p < 0.01$). Initial trust ($r = 0.768, p < 0.01$) as the MeV has a high positive correlation with the DV.

In relation to respondents’ demographic variables, the correlation matrix indicates that gender, age, education, income and marital status are statistically insignificant. The correlation coefficients of the demographic variables are close to zero which suggests no linear association between IVs, mediation variable and DV. According to Baron and Kenny (1986, p. 1174), it is desirable that the moderator variable is uncorrelated with both the IV and the DV to provide a clear interpretable interaction. Further analysis of the MoV and MeV are presented in the next section using Hayes’ Process Macro.

6.3 Mediation and moderation analysis
The Hayes’ Process Macro developed by Hayes (2013) was used as a statistical moderation and mediation analysis in SPSS to estimates the path coefficients using multiple regression for the continuous outcome (Preacher and Hayes, 2008). It provided insights on the boundary conditions pertaining to the direct and indirect effect of the IV on the DV through the existence of MoV and mediation variables.

6.3.1 Mediation analysis. Mediation was tested using “Model 4” in Process Macro (Hayes, 2013) as shown in Table IX. Initial trust as mediator was entered into the Process Macro as covariates; 5,000 bias-corrected bootstrap samples and 95 per cent confidence intervals were used in the model (Preacher and Hayes, 2008). The overall models were significant:

<table>
<thead>
<tr>
<th>Variables</th>
<th>No. of questions</th>
<th>Tolerance</th>
<th>VIF</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Lowest</td>
<td>Highest</td>
</tr>
<tr>
<td>Disposition to trust</td>
<td>6</td>
<td>0.734</td>
<td>0.628</td>
</tr>
<tr>
<td>Infrastructure quality</td>
<td>6</td>
<td>0.853</td>
<td>0.575</td>
</tr>
<tr>
<td>Perceived costs</td>
<td>6</td>
<td>0.789</td>
<td>0.710</td>
</tr>
<tr>
<td>Privacy</td>
<td>6</td>
<td>0.755</td>
<td>0.670</td>
</tr>
<tr>
<td>Security</td>
<td>6</td>
<td>0.758</td>
<td>0.580</td>
</tr>
<tr>
<td>Initial trust</td>
<td>5</td>
<td>0.753</td>
<td>0.568</td>
</tr>
</tbody>
</table>

Table VII.
Test of multicollinearity

Note: Dependent variable: behavioral intention
<table>
<thead>
<tr>
<th></th>
<th>G</th>
<th>A</th>
<th>E</th>
<th>I</th>
<th>MS</th>
<th>DT</th>
<th>PC</th>
<th>IQ</th>
<th>PP</th>
<th>PS</th>
<th>IT</th>
<th>BI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender (G)</td>
<td>1</td>
<td>-0.157**</td>
<td>-0.109</td>
<td>-0.082</td>
<td>-0.031</td>
<td>-0.058</td>
<td>-0.062</td>
<td>0.036</td>
<td>0.009</td>
<td>0.035</td>
<td>0.043</td>
<td>0.006</td>
</tr>
<tr>
<td>Age (A)</td>
<td>-0.157**</td>
<td>1</td>
<td>0.628**</td>
<td>0.398**</td>
<td>0.561**</td>
<td>0.080</td>
<td>0.046</td>
<td>-0.023</td>
<td>0.099</td>
<td>0.080</td>
<td>0.123*</td>
<td>0.016</td>
</tr>
<tr>
<td>Education (E)</td>
<td>0.005</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.157</td>
<td>0.416</td>
<td>0.686</td>
<td>0.080</td>
<td>0.156</td>
<td>0.030</td>
<td>0.780</td>
</tr>
<tr>
<td>Income (I)</td>
<td>-0.109</td>
<td>0.628**</td>
<td>1</td>
<td>0.225**</td>
<td>0.392**</td>
<td>0.011</td>
<td>-0.003</td>
<td>-0.031</td>
<td>0.048</td>
<td>0.041</td>
<td>0.064</td>
<td>0.000</td>
</tr>
<tr>
<td>Marital status (MS)</td>
<td>0.055</td>
<td>0.000</td>
<td>-0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.820</td>
<td>0.960</td>
<td>0.584</td>
<td>0.396</td>
<td>0.466</td>
<td>0.257</td>
</tr>
<tr>
<td>Disposition to trust (DT)</td>
<td>0.055</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.820</td>
<td>0.960</td>
<td>0.584</td>
<td>0.396</td>
<td>0.466</td>
<td>0.257</td>
</tr>
<tr>
<td>Perceived costs (PC)</td>
<td>-0.082</td>
<td>0.398**</td>
<td>0.225**</td>
<td>1</td>
<td>0.587**</td>
<td>0.057</td>
<td>0.069</td>
<td>0.039</td>
<td>0.045</td>
<td>0.085</td>
<td>0.039</td>
<td>0.064</td>
</tr>
<tr>
<td>Infrastructure quality (IQ)</td>
<td>0.147</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.311</td>
<td>0.224</td>
<td>0.486</td>
<td>0.423</td>
<td>0.134</td>
<td>0.488</td>
<td>0.362</td>
</tr>
<tr>
<td>Perceived privacy (PP)</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
</tr>
<tr>
<td>Perceived security (PS)</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
</tr>
<tr>
<td>Initial trust (IT)</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
</tr>
<tr>
<td>Behavioral intention (BI)</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
<td>0.314</td>
</tr>
</tbody>
</table>

Notes: N = 314; * Correlation is significant at the 0.05 level (two-tailed); ** Correlation is significant at the 0.01 level (tailed)
Disposition to trust: The overall model was significant \( F(2, 311) = 319.68, p < 0.001, R^2 = 0.67 \).

Infrastructure quality: The overall model was significant \( F(2, 311) = 228.71, p < 0.001, R^2 = 0.60 \).

Perceived costs: The overall model was significant \( F(2, 311) = 259.07, p < 0.001, R^2 = 0.62 \).

Privacy: The overall model was significant \( F(2, 311) = 291.13, p < 0.001, R^2 = 0.65 \).

Security: The overall model was significant \( F(2, 311) = 274.16, p < 0.001, R^2 = 0.64 \).

In Path c, the regression shows that all IVs were statistically significant with the behavioral intention to use mobile banking, ignoring the initial trust as the mediator. It confirmed a positive relationship between IV and DV with \( p < 0.01 \). Hence, H1c, H2c, H3c, H4c and H5c were supported. In Path a, the regression analysis confirmed a positive association between all the IV and initial trust as the MeV, without the presence of behavioral intention. Hence, H1a, H2a, H3a, H4a and H5a were supported. In Path b, the results showed that initial trust as the mediator was positively associated with behavioral intention. Lastly in Path c’, the IVs were significant predictors for both the DV and MV, and both a-path and b-path were significant. Direct effects of IV, namely, disposition to trust (\( \beta = 0.669, t (314) = 7.5826, p = < 0.01 \)), infrastructure quality (\( \beta = 0.100, t (314) = 1.995, p = < 0.05 \)), perceived costs (\( \beta = 0.352, t (314) = 5.373, p = < 0.01 \)), privacy (\( \beta = 0.673, t (314) = 7.426, p = < 0.01 \)) and

Table IX.
Summary of mediation analysis using Hayes’ process macro

<table>
<thead>
<tr>
<th>Path c</th>
<th>Coefficient</th>
<th>SE</th>
<th>t</th>
<th>p</th>
<th>LLCI</th>
<th>ULCI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disposition of trust</td>
<td>1.224</td>
<td>0.061</td>
<td>19.952</td>
<td>0.000*</td>
<td>1.104</td>
<td>1.345</td>
</tr>
<tr>
<td>Infrastructure quality</td>
<td>0.533</td>
<td>0.061</td>
<td>8.723</td>
<td>0.000*</td>
<td>0.413</td>
<td>0.653</td>
</tr>
<tr>
<td>Perceived costs</td>
<td>0.872</td>
<td>0.081</td>
<td>10.775</td>
<td>0.000*</td>
<td>0.713</td>
<td>1.031</td>
</tr>
<tr>
<td>Privacy</td>
<td>1.194</td>
<td>0.056</td>
<td>21.492</td>
<td>0.000*</td>
<td>1.085</td>
<td>1.303</td>
</tr>
<tr>
<td>Security</td>
<td>1.020</td>
<td>0.054</td>
<td>19.424</td>
<td>0.000*</td>
<td>0.917</td>
<td>1.124</td>
</tr>
</tbody>
</table>

Path a

| Disposition of trust | 0.672       | 0.0375| 17.903| 0.000* | 0.598 | 0.746 |
| Infrastructure quality | 0.344       | 0.0342| 10.063| 0.000* | 0.277 | 0.411 |
| Perceived costs      | 0.447       | 0.0485| 9.216 | 0.000* | 0.352 | 0.543 |
| Privacy               | 0.733       | 0.0288| 25.406| 0.000* | 0.676 | 0.798 |
| Security              | 0.627       | 0.0278| 22.554| 0.000* | 0.572 | 0.681 |

Path b

| MeV in disposition of trust path | 0.826       | 0.0800| 10.323| 0.000* | 0.668 | 0.983 |
| MeV in infrastructure quality path | 1.260       | 0.0719| 17.515| 0.000* | 1.118 | 1.401 |
| MeV in perceived costs path      | 1.132       | 0.0679| 17.126| 0.000* | 1.029 | 1.206 |
| MeV in privacy path              | 0.712       | 0.1015| 7.008 | 0.000* | 0.512 | 0.911 |
| MeV in security path             | 0.846       | 0.0957| 8.829 | 0.000* | 0.340 | 0.640 |

Path c’

| Disposition of trust | 0.669       | 0.076 | 8.863 | 0.000* | 0.521 | 0.818 |
| Infrastructure quality | 0.100       | 0.050 | 1.995 | 0.047**| 0.001 | 0.198 |
| Perceived costs      | 0.352       | 0.066 | 5.373 | 0.000* | 0.223 | 0.481 |
| Privacy               | 0.673       | 0.091 | 7.426 | 0.000* | 0.495 | 0.851 |
| Security              | 0.490       | 0.076 | 6.421 | 0.000* | 0.339 | 0.640 |

Notes: *p < 0.01; **p < 0.05
security ($\beta = 0.490$, $t (314) = 6.421$, $p = < 0.01$) were positively associated with behavioral intention to use mobile banking with the present of initial trust as MeV. Hence, $H1c'$, $H2c'$, $H3c'$, $H4c'$ and $H5c'$ were supported.

A measure of the indirect effect of IV on DV was presented in Table X after the regression models. According to Preacher and Hayes (2004), the indirect effect of IV on DV in this situation was defined as the product of Path $a$ and Path $b$ or $ab$. In most situations, $ab = c - c'$, where the total effect of IV and DV known as Path $c$ can be decomposed into a direct component of Path $c'$ and an indirect component of Path $ab$ (Sobel, 1982). The significance of the indirect effect can be determined by examining the lower and upper bounds of the 95 per cent confidence intervals. Indirect effect was statistically significant because zero does not occur between the lower limit confidence interval (LLCI) and the upper limit confidence interval (ULCI). Therefore, we can conclude that the indirect effect for initial trust as mediator is significant.

In the case of the effect size for the indirect effect with a 95 per cent confidence interval which did not include zero were all significantly greater than zero. The $p$-values are drawn from the unit normal distribution under the assumption of a two-tailed $z$-test of the hypothesis that the mediated effect equals zero in the population; ± 1.96 was the critical value of the test ratio which contained the central 95 per cent of the unit normal distribution (Preacher and Leonardelli, 2010). Because the calculated values of $z$ for the Sobel test (normal theory test) = $z$-score were all above 1.96, it meant that initial trust mediates the relationship between IV and DV.

6.3.2 Moderation analysis. Simple moderation was examined using “Model 1” in Process (Hayes, 2013) as shown in Table XI. Gender, age, education, income and marital status were entered into the Process Macro as covariates. 5,000 bias-corrected bootstrap samples and 95 per cent confidence intervals were used in the model (Preacher and Hayes, 2008). To test the Path $d$ hypothesis – $H1d$, $H2d$, $H3d$, $H4d$ and $H5d$, that behavioral intentions are a function of various antecedents of initial trust, and more specifically whether demographic variables moderates the relationship of both variables – a hierarchical multiple regression analysis was conducted.

Table XI shows the first step which is the overall model; two variables were included: antecedents of initial trust (disposition to trust, infrastructure quality, perceived costs, privacy and security) and demographic variables (gender, age, education, income and marital status). These variables accounted for a significant amount of variance in behavioral intention to use mobile banking. However, the second step which shows the interaction between behavioral intention and IVs moderated by demographic variables were not significant. It shows that the interaction between antecedents of initial trust and demographic variables accounted for an insignificant amount of variance in behavioral intention to use mobile banking, meaning that demographic variables do not strengthen the direct effect of antecedents of initial trust on behavioral intention. The results show that zero value lies between the negative LLCI and the positive ULCI. Therefore, moderation in not occurring. Based on these results, Path $d$

<table>
<thead>
<tr>
<th>Indirect effect</th>
<th>Effect</th>
<th>Boot se</th>
<th>Boot LLCI</th>
<th>Boot ULCI</th>
<th>$z$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disposition of trust</td>
<td>0.555</td>
<td>0.086</td>
<td>0.402</td>
<td>0.733</td>
<td>8.932</td>
<td>0.000*</td>
</tr>
<tr>
<td>Infrastructure quality</td>
<td>0.433</td>
<td>0.065</td>
<td>0.324</td>
<td>0.548</td>
<td>8.715</td>
<td>0.000*</td>
</tr>
<tr>
<td>Perceived cost</td>
<td>0.520</td>
<td>0.069</td>
<td>0.389</td>
<td>0.661</td>
<td>8.105</td>
<td>0.000*</td>
</tr>
<tr>
<td>Privacy</td>
<td>0.521</td>
<td>0.089</td>
<td>0.340</td>
<td>0.691</td>
<td>6.751</td>
<td>0.000*</td>
</tr>
<tr>
<td>Security</td>
<td>0.530</td>
<td>0.082</td>
<td>0.339</td>
<td>0.640</td>
<td>8.214</td>
<td>0.000*</td>
</tr>
</tbody>
</table>

Table X. Indirect effect of X on Y

Note: *$p < 0.01$
hypothesis – H1d, H2d, H3d, H4d and H5d – were not supported. These findings are inconsistent with the findings from some similar past studies (Cruz et al., 2010; Fall et al., 2015; Iddris, 2013; Joshua and Koshy, 2011; Karjaluoto et al., 2002; Laforet and Li, 2005; Laukkanen and Pasanen, 2008; Laukkanen, 2016; Mattila et al., 2003; Mann and Sahni, 2012; Meuter et al., 2005; Munnukka, 2007; Suoranta and Mattila, 2004).

6.4 Summary of empirical results

The results of this research have provided evidence that the conceptualization of mediation analysis (antecedents, initial trust and behavioral intention) acts as the starting point of interpretation and can be guided by theories or previous research thus providing a more realistic representation of the antecedents of initial trust that influence the adoption of mobile banking in developing countries. In short, they are valid measures of the underlying construct of initial trust and behavioral intention. Nevertheless, any conceptual framework can be subjected to further improvement and we encourage scholars and practitioners to work on improving it further (Table XII).
7. Conclusion and implications

7.1 Contributions to research and practice

Wireless financial services continue to become ingrained in society due to the rapid development of mobile devices. It enhances the development of the banking system in each country. However, diffusion of new mobile banking services cannot fully achieve expected

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<table>
<thead>
<tr>
<th>Path/s</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>c path – Total effect – to determine which antecedents greatly influence non-adopters’ initial trust</td>
<td></td>
</tr>
<tr>
<td>$H1c$. Disposition to trust significantly influences behavioral intention to use mobile banking</td>
<td>Significant</td>
</tr>
<tr>
<td>$H2c$. Infrastructure quality significantly influences behavioral intention to use mobile banking</td>
<td>Significant</td>
</tr>
<tr>
<td>$H3c$. Perceived costs significantly influence behavioral intention to use mobile banking</td>
<td>Significant</td>
</tr>
<tr>
<td>$H4c$. Privacy significantly influences behavioral intention to use mobile banking</td>
<td>Significant</td>
</tr>
<tr>
<td>$H5c$. Security significantly influences behavioral intention to use mobile banking</td>
<td>Significant</td>
</tr>
<tr>
<td>a path – to determine the effect of IV on MeV</td>
<td></td>
</tr>
<tr>
<td>$H1a$. Disposition to trust significantly influences customer’s initial trust</td>
<td>Significant</td>
</tr>
<tr>
<td>$H2a$. Infrastructure quality significantly influences customer’s initial trust</td>
<td>Significant</td>
</tr>
<tr>
<td>$H3a$. Perceived costs significantly influence customer’s initial trust</td>
<td>Significant</td>
</tr>
<tr>
<td>$H4a$. Privacy significantly influences customer’s initial trust</td>
<td>Significant</td>
</tr>
<tr>
<td>$H5a$. Security significantly influences customer’s initial trust</td>
<td>Significant</td>
</tr>
<tr>
<td>b path – to determine the effect of MeV on DV</td>
<td></td>
</tr>
<tr>
<td>$H1b$. Customer’s initial trust significantly influences behavioral intention in disposition to trust path</td>
<td>Significant</td>
</tr>
<tr>
<td>$H2b$. Customer’s initial trust significantly influences behavioral intention in infrastructure quality path</td>
<td>Significant</td>
</tr>
<tr>
<td>$H3b$. Customer’s initial trust significantly influences behavioral intention in perceived costs path</td>
<td>Significant</td>
</tr>
<tr>
<td>$H4b$. Customer’s initial trust significantly influences behavioral intention in privacy path</td>
<td>Significant</td>
</tr>
<tr>
<td>$H5b$. Customer’s initial trust significantly influences behavioral intention in security path</td>
<td>Significant</td>
</tr>
<tr>
<td>c’ path – Direct effect – to determine the mediating effects of initial trust between antecedents and non-adopters’ behavioral intention</td>
<td></td>
</tr>
<tr>
<td>$H1c’$. The relationship between the disposition to trust and behavioral intention to use mobile banking is fully mediated by initial trust</td>
<td>Significant</td>
</tr>
<tr>
<td>$H2c’$. The relationship between perceived costs and behavioral intention to use mobile banking is fully mediated by initial trust</td>
<td>Significant</td>
</tr>
<tr>
<td>$H3c’$. The relationship between privacy and behavioral intention to use mobile banking is fully mediated by initial trust</td>
<td>Significant</td>
</tr>
<tr>
<td>$H4c’$. The relationship between security and behavioral intention to use mobile banking is fully mediated by initial trust</td>
<td>Significant</td>
</tr>
<tr>
<td>d path – Moderating effect on c path – to determine the moderating effects of demographic variables between antecedents and non-adopters’ behavioral intention</td>
<td></td>
</tr>
<tr>
<td>$H1d$. The relationship between the disposition to trust and behavioral intention to use mobile banking is fully moderated by demographic profile (gender, age, education, income and marital status)</td>
<td>Insignificant</td>
</tr>
<tr>
<td>$H2d$. The relationship between infrastructure quality and behavioral intention to use mobile banking is fully moderated by demographic profile (gender, age, education, income and marital status)</td>
<td>Insignificant</td>
</tr>
<tr>
<td>$H3d$. The relationship between perceived costs and behavioral intention to use mobile banking is fully moderated by demographic profile (gender, age, education, income and marital status)</td>
<td>Insignificant</td>
</tr>
<tr>
<td>$H4d$. The relationship between privacy and behavioral intention to use mobile banking is fully moderated by demographic profile (gender, age, education, income and marital status)</td>
<td>Insignificant</td>
</tr>
<tr>
<td>$H5d$. The relationship between security and behavioral intention to use mobile banking is fully moderated by demographic profile (gender, age, education, income and marital status)</td>
<td>Insignificant</td>
</tr>
</tbody>
</table>

Table XII. Research objectives and hypothesis
benefits if it is not used by all banking consumers. Results show that this study supported
the study of Chiu et al. (2016) on the issues that influence initial trust on behavioral intention
to use internet banking in the Philippines. The responses of non-adopters asserted that
initial trust played a significant impact on behavioral intention whether to use mobile
banking services. Disposition to trust (Kim et al., 2009; Zhou, 2011), infrastructure quality
(Almogbil, 2005; Gerrard and Cunningham, 2003; Pikkarainen et al., 2004; Poon, 2007;
Rotchanakitumnuai and Speece, 2003), perceived costs (Cruz et al., 2010; Luarn and Lin,
2005; Wu and Wang, 2005; Wessels and Drennan, 2010; Yu, 2012), privacy (Bidarra et al.,
2013; Casaló et al., 2007; Wang and Shan, 2013) and security (Bidarra et al., 2013; Laukkanen,
2007; Ouyang, 2012; Susanto et al., 2016) are widely recognized as the main obstacles to the
adoption of mobile banking in the Philippines.

The banks have little and no control over the development of internet connectivity and
speed in the country. It is limited due to deficiencies in the regulatory framework, broadband
infrastructure development and the limitations of existing telecom infrastructure, especially
in remote areas. Banks should work with the government or telecom companies to address
rural population access, build regulatory capacities, strengthen regulatory frameworks and
public-private partnerships for regional connectivity. Any incremental efforts to lower
prices or provide better rates of internet subscription would have a tremendous impact on
affordability and hence access. Banks can concentrate on other factors that are under their
control such as improving online privacy and security practices such as safeguarding
customer data and information such as security compliance, third-party seals, certification,
guarantees and regulations. It is more than preventing unauthorized access to their
customers’ data and funds. Winning customers trust, both in the retail and commercial
space, is the key to boosting banks’ bottom lines.

The study also proves that customers’ demographic variables as MoV such as gender,
age, education, household income and marital status have insignificant impact on the
ancestors of initial trust and willingness to use mobile banking. Even demographic
variables did not yield a result that was anticipated; we encourage the financial institution to
identify relevant customer needs through customer segmentation. Understanding the
preferences of urban households, young and educated professionals, affluent groups of
customers, overseas workers and entrepreneurs while alleviating the fears and lack of
understanding of non-adopters could increase the growth mobile banking adoption and
retention. Particularly, the individual with entrepreneurial characteristics and inclination
are risk-taker and proactive to acquire new ideas that involve innovation at the inception
stage of the introduction of mobile banking services into the market. Financial institutions
need to focus on how they can market the entrepreneurial nature of mobile banking as a
useful technological innovation for the growth of their businesses.

The financial institutions must devote more resources to encourage people to learn
mobile banking benefits and usages. Therefore, banks should equip their customers with
awareness, knowledge and trialability at the beginning of their relationship with the
consumer. Effective marketing services depend on trust building formation before the
customer experience the online services. Maintaining customer confidence at all times is
crucial in building customer relationships.

7.2 Limitation and future research
The present study makes a modest attempt to identify various factors that influence non-
adopters’ initial trust as a means of adopting mobile banking in the developing country
particularly in urban cities. Also, the popularity and growth of mobile phones for many low-
income individuals in developing countries use as cost-effective ways of financial
management, and entrepreneurial activities require more attention to academic scholars. Future studies are expected to validate and expand the model of this study.

Previous studies were done in different countries such as developed and developing using a variety of factors. This study investigates only a few factors that are strongly believed to have an influenced to mobile banking adoption in developing countries like the Philippines. Hence, other elements can be included in future research. It would be interesting to empirically assess the relative effect of the various motivational factors of customers and environmental factors as antecedents of initial trust to different groups. Future studies would benefit from observing actual interactions of financial institutions and non-adopters to develop concrete marketing strategies. Researchers can also test the validity of factors in every stage of trust over time or how customers’ trust will develop over time.

This study does not measure cultural dimensions such as difference among developed, developing and under-developed countries which cannot claim with confidence a link between culture and factors that influence initial trust of non-adopters. Further research to test the validity of these proposed mechanisms are required to understand individual differences across diversified demographic characteristics, different cultural background and psychological disposition that may influence their initial trust. Further studies to answer research questions such as how banks can tailor their mobile banking and services to each region or culture effectively can bring about a new theory of online trust in global environments.

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Corresponding author
Candy Lim Chiu can be contacted at: candyatwork@gmail.com

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