Korean 3 Smartphone Companies' Patent Portfolio Comparison : Samsung, LG, and Pantech

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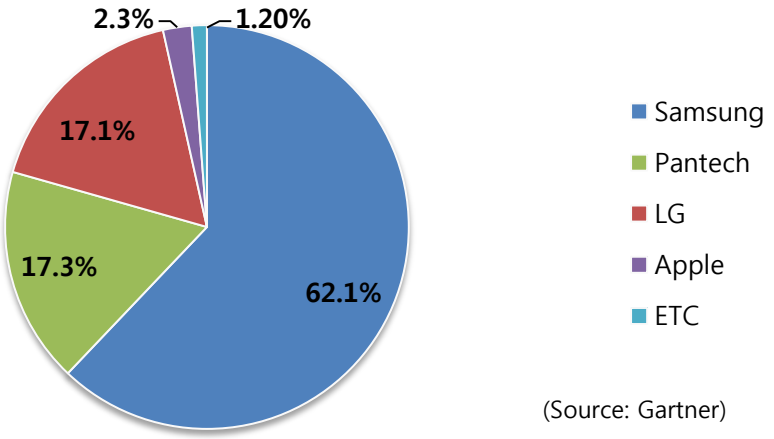
1. Introduction

1-1. Background

Samsung, LG and Pantech are Korea's leading mobile companies that have been dominating Korean domestic mobile market for the last decade. It is not too much to say that many global mobile companies have experienced market entry barrier in Korea because of these three Korean mobile companies. In the first half of 2012, the domestic smartphone market share of each company was 62.1% for Samsung, 17.3% for Pantech, and 17.1% for LG, according to Gartner, the IT research and consulting company. The market share result proves that many global mobile companies have little competitive power in Korean domestic market.



(Source: Gartner)

[Figure 1: Korean Domestic Smart Phone Sales Market Share in first half of 2012]

Samsung became the world's leading smartphone company in a short time with its semiconductor technologies and its strong hardware technologies. In addition, the patent disputes with Apple gave Samsung the reputation as a company competing for the top spot in the world market. Even though Samsung smartphones are the top-selling brand, LG and Pantech have secured their part in Korean domestic market despite of Samsung's dominant monopoly-like power. LG raised its sales revenue while Samsung was facing number of disputes. According to Korean Financial News, LG's smartphone sales in the first half of 2013 were 12.1 million, showing 17% growth of around 2 million more sales than the previous year.[1] During the last decade (2003-2012), Pantech faced a serious crisis and almost died out after the appearance of smartphone technologies. However, it recovered its market power recently and even won the number two position in the Korean domestic smart phone market

[1]Korean Financial News
http://www.fnnews.com/view?ra=Sent0901m_View&corp=fnnews&arcid=2013072501002673500150097&cDateYear=2013&cDateMonth=07&cDateDay=25

in the first half of 2012.

Patent is the figure of each company's technological efforts and strategies. To see these three companies' technological development, WIPS analyzed Samsung, LG and Pantech's patent portfolios during the last decade based on its online patent search engine, WIPS Global. The report compares the capabilities of mobile technologies, especially smartphones. Through the Patent analysis, we could conclude companies' current patent status, patent strategy, and so on.

1-2. Methodology

Each company's smartphone related patent data was extracted from the patent database search service of the WIPS Global from the year 2003 to year 2012 to see the recent patent application trend in smartphone technologies. In general, companies file international application after they file domestic application due to general patent system, which follows the territorial principle. For this reason, the analysis used the number of Korean domestic applications as an indicator, which identifies Korean domestic patent application activities in a specific time period to understand the competitor's patent application activities.

We have not included database of each company's affiliates to get more refined search result. The patent search scope is carried out with the patent search including the smartphone keywords in the title, abstract, and claims. Noises have been removed from the raw data search result.

1-3. Main Analysis Contents

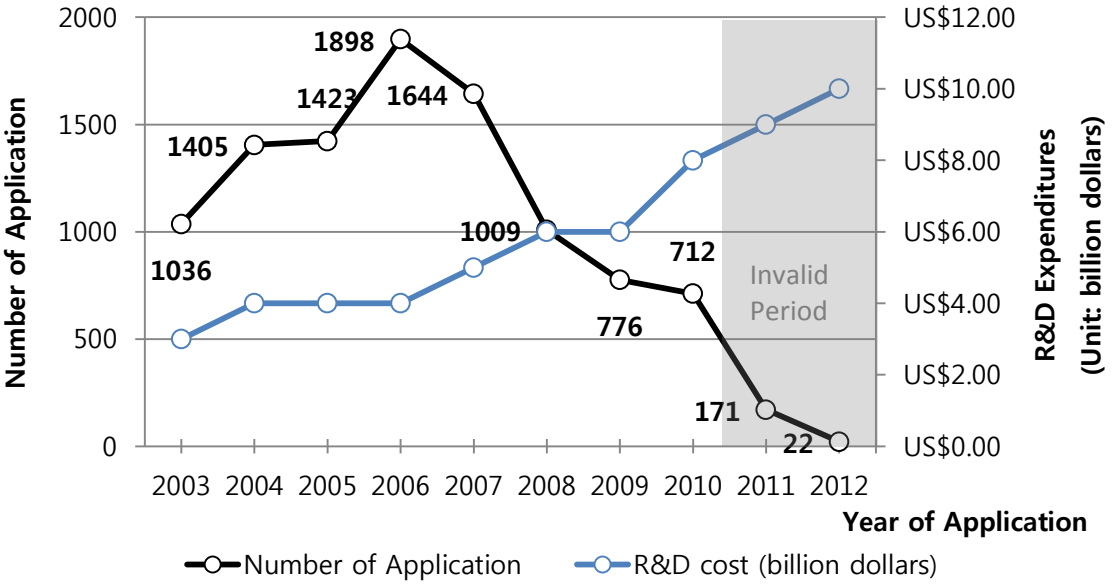
- Samsung, LG, and Pantech's patent application activities and R&D expenditure status for the last 10 years (2003 to 2012).
- Samsung, LG, and Pantech's recent technology areas of focuses
- Samsung, LG and Pantech's market status based on patent family information.
- Samsung, LG and Pantech's technology impact status based on triadic patent family information, citation information and its main technology area information.

2- The Analysis Result of Samsung's Patent Portfolio

2-1. Application Activity

The total number of Korean smart phone patent applications filed by Samsung was 10,096 for the past ten years (2003-2013). The number of Samsung's smart phone patent applications has increased between the year 2003 and 2006. Ever since it reached the highest point in 2006, the number of application has consistently decreased.

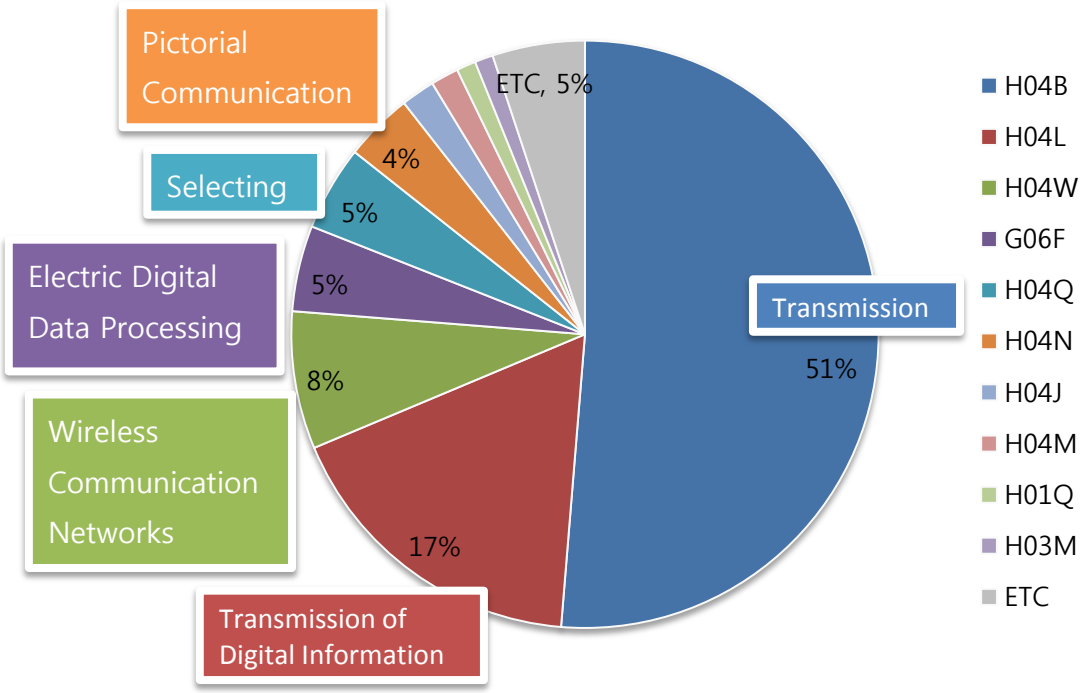
While the R&D expenditure increased during the last decade, its number of application has decreased. It somewhat proves that Samsung is concentrating on the quality of its patent portfolio instead of on its quantity.



[Figure 2: Samsung's Total Application Status and R&D cost status by year]

2-2. Samsung's Technology Trend

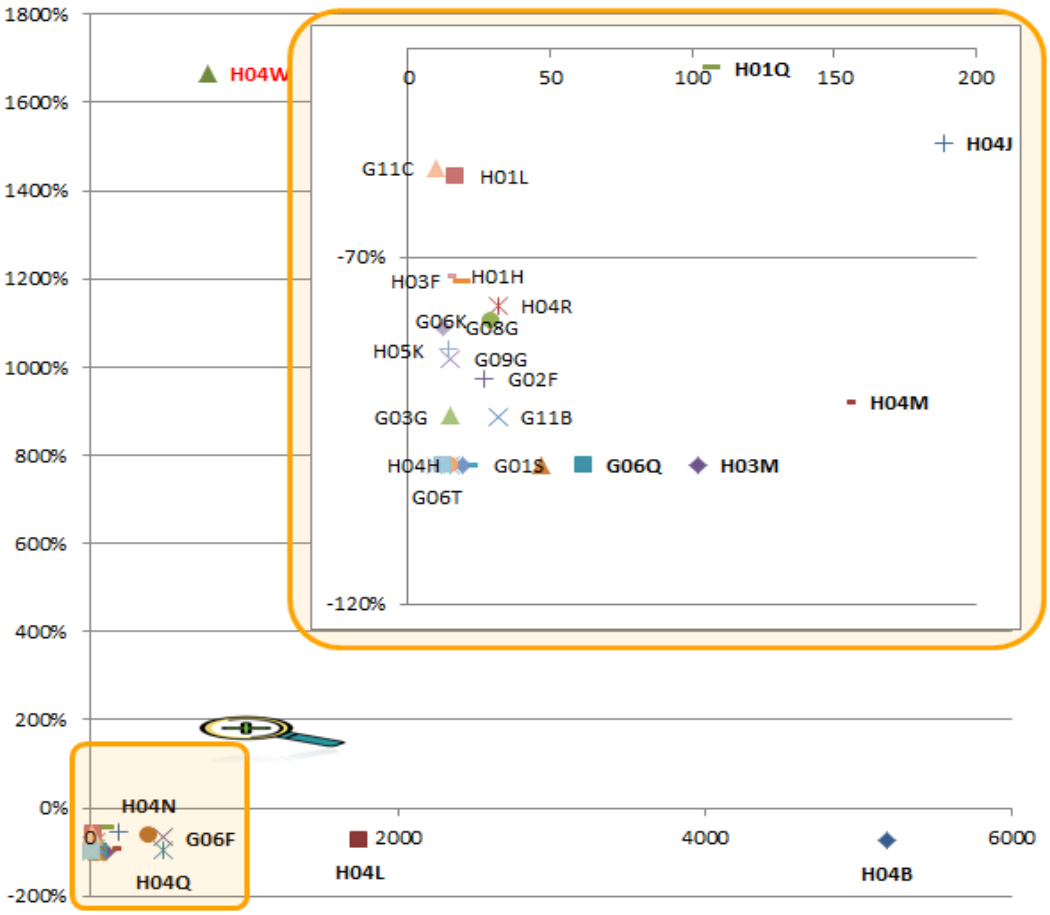
Through Samsung's top IPC chart, we could analyze its most applied smartphone technologies during the last 10 years. The result shows that Samsung secured technologies in the field of transmission (H04B, 51%) technologies the most. Samsung also concentrated in securing the transmission of digital information (H04L, 17%) and wireless communication networks (H04W, 8%).



[Figure 3: Samsung's Top Smartphone Technologies during the years 2003 and 2012]

To look at Samsung's technology trend changes, comparison was made with company's smartphone technologies between 2003-2007 and 2008-2012.

The most outstanding change was H04W's (Wireless communication network) drastic growth (more than 1500%) which never appeared on the top applied technology list during 2003-2007. Another significant change was H04Q's (selection technologies) exclusion from the top applied technology list during the year 2008-2012.



The vertical axis: [(Number of Applications during the year 08-12-Number of Applications during the year 03-07)/Number of Applications during the year 08-12]*100

[Figure 4: Samsung's Technology Trends between the Years 2003-2007 and 2008-2012]

[Samsung's Top Technology Application Status]

Year 03-07			Year 08-12		
Rank	IPC	Number of Application	Rank	IPC	Number of Application
1	H04B	4136	1	H04B	1043
2	H04L	1389	2	H04W	724
3	H04Q	457	3	H04L	366
4	G06F	360	4	G06F	117
5	H04N	279	5	H04N	102

WIPS conducted the analysis on H04W (Wireless communication networks) technologies which recently have been applied the most. Among wireless communication network technologies, the main technologies during the last 10 years were wireless resource allocation, messaging, services making use of the location for users at terminals, wireless traffic scheduling, and discovering technologies. Since smartphones are pursuing internet free

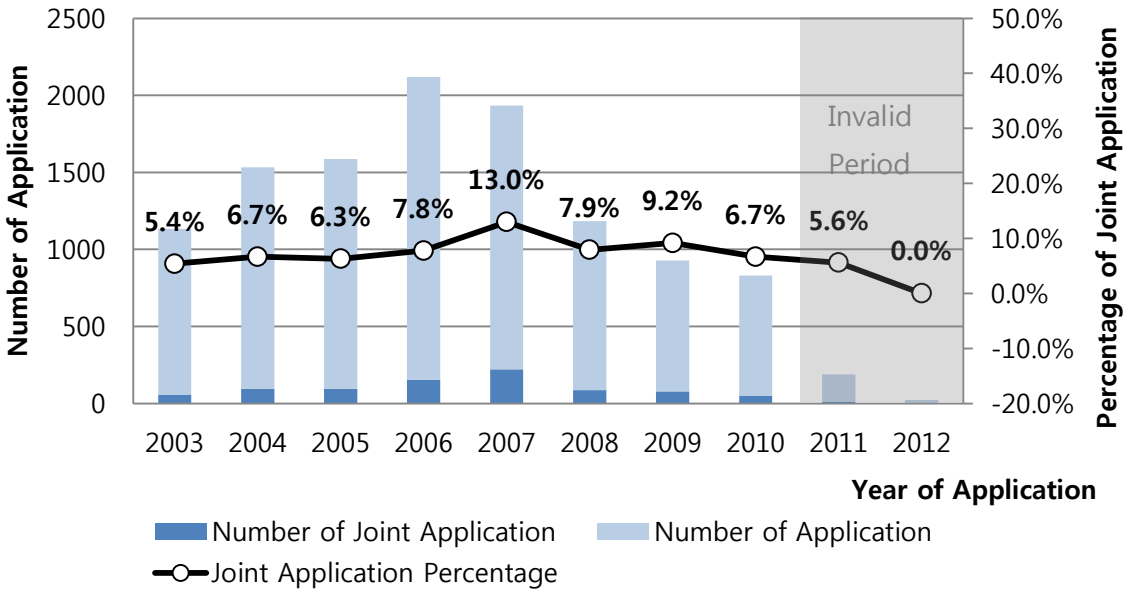
environment, Samsung had to secure technologies related to wireless network systems.

[Samsung's Main Technology Field: H04W]

IPC	Description	No.of Appl.
H04W-072/04	wireless resource allocation	46
H04W-004/12	messaging	22
H04W-004/02	Services making use of the location for users of terminals	22
H04W-072/12	Wireless traffic scheduling	21
H04W-048/16	Discovering; Processing access restriction or access information	20
H04W-012/06	Authentication	19
H04W-074/08	Non-scheduled access	18
H04W-076/02	Connection set-up	18
H04W-024/10	Scheduling measurement reports	18
H04W-088/06	adopted for operation in multiple networks	18
H04W-004/06	Selective distribution of broadcast; Services to user groups; On-way selective calling services	17
H04W-052/02	Power saving arrangements	17

2-3. Samsung's Joint Application Status

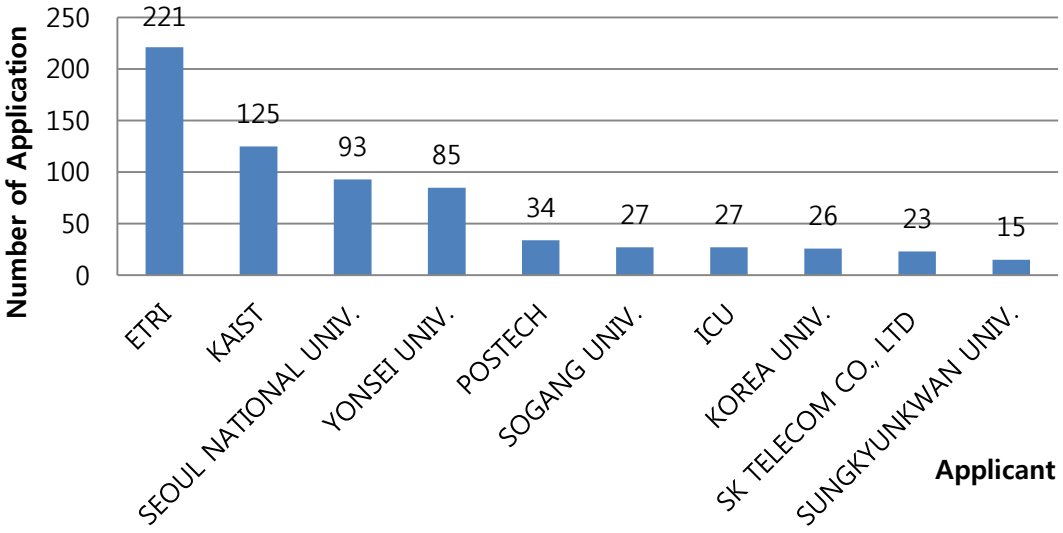
WIPS analyzed joint application status to determine Samsung's open-innovation level. According to the joint application status chart, Samsung has maintained the percentage ranges between 5% and 7% for last 10 years except the year 2007 (13%) and 2009 (9.2%).



[Figure 5: Joint Application Status by Year]

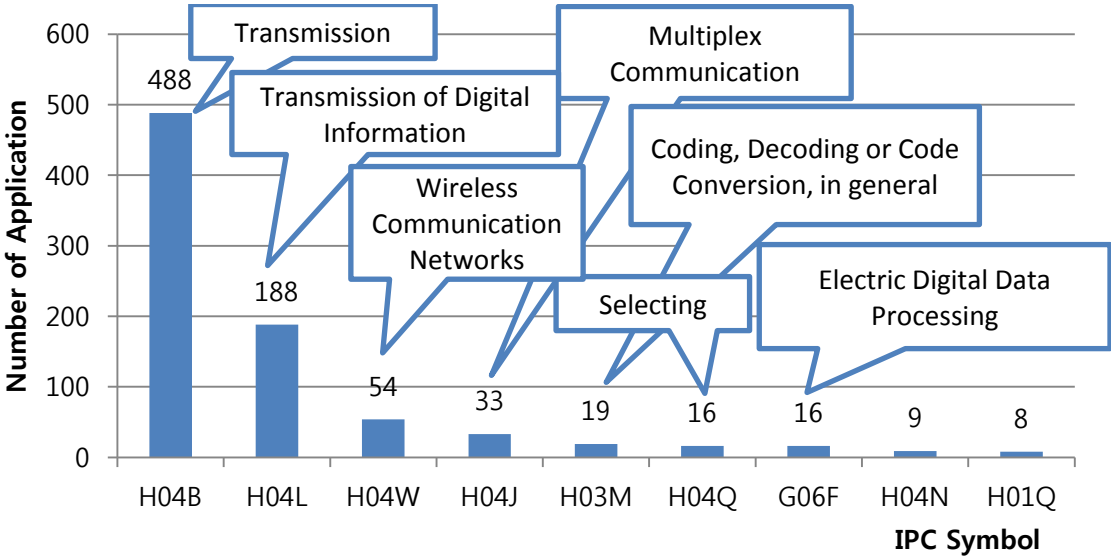
Samsung's main joint applicants are government funded research institution, ETRI and

universities. One of Samsung's special features is that 8 of top 10 joint applicants are universities. Another feature is that there is only one private entity, SK Telecom, among top 10 applicants.



[Figure 6: Samsung's Top 10 Joint Applicants]

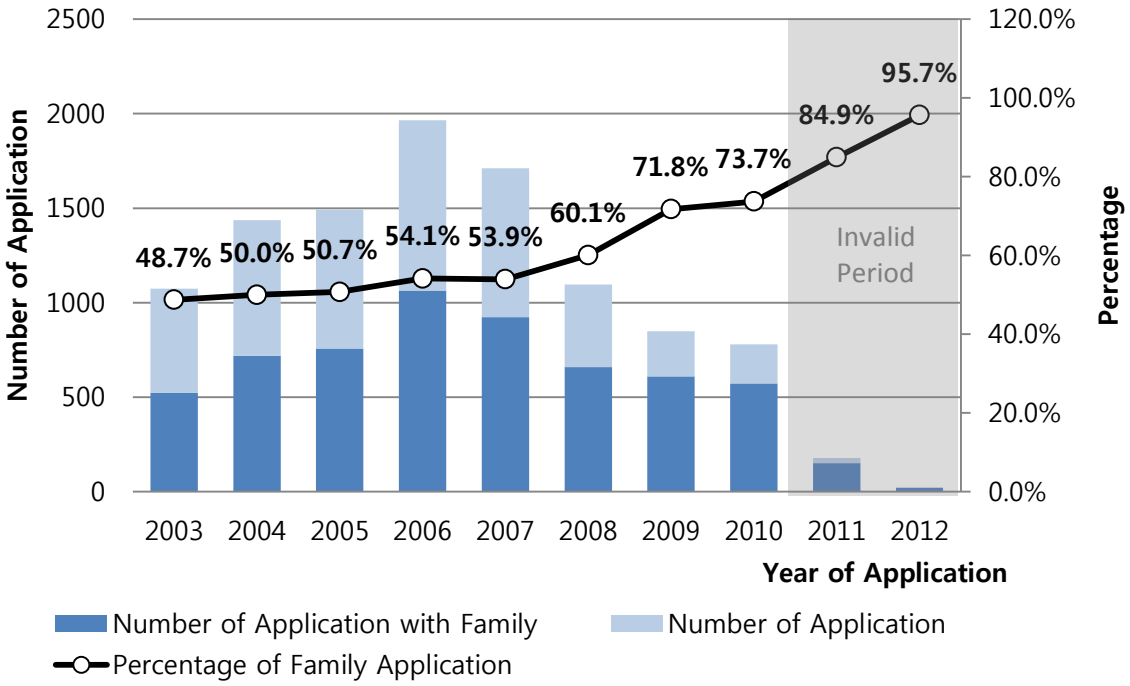
Joint applicants' focused areas of technology reveal that the number of H04B technology ranked first among other technologies. Samsung's upcoming technology, H04W, has ranked third among other technologies.



[Figure 7: Samsung's Top 10 technology areas of joint application]

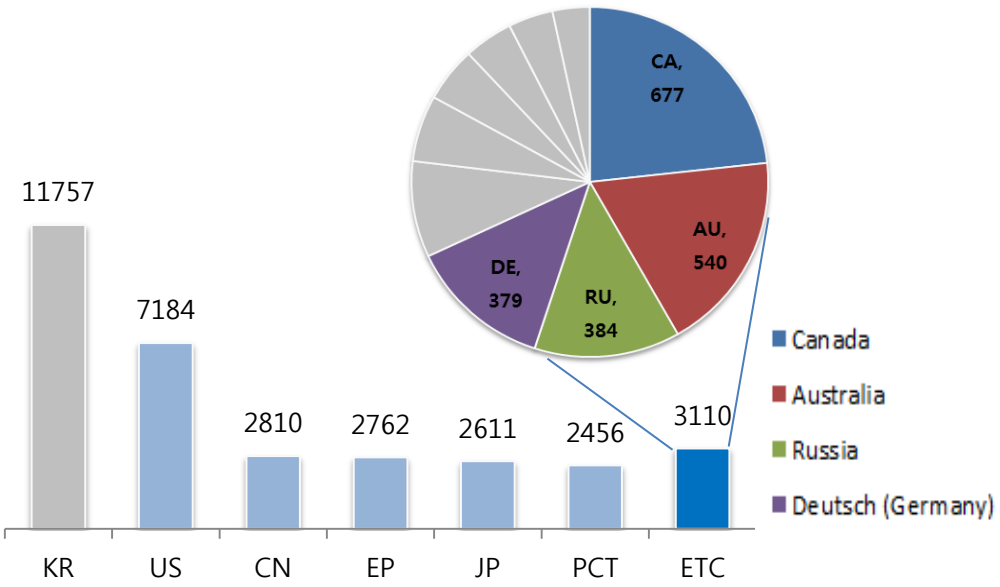
2-4. Samsung's Family Application Status

To see Samsung's patent globalization status, we analyzed Samsung's family application status. Samsung's percentage of family application per year has remained around 50% until the year 2007. Its percentage continuously increased and reached 73.7% in 2008, while annual patent application activity was decreasing. It proves that Samsung has been trying to improve its patent portfolio by applying international patent filings.



[Figure 8: Samsung's Family Application Status]

We analyzed company's targeting market based on Samsung's family application distribution by country information. The analysis showed that Samsung was obviously concentrating on U.S. market. Samsung also applied almost equally to other international patent offices including China, Europe, and Japan. Other than these countries, Samsung was also targeting markets in Canada, Australia, Russia, and Germany, as well.

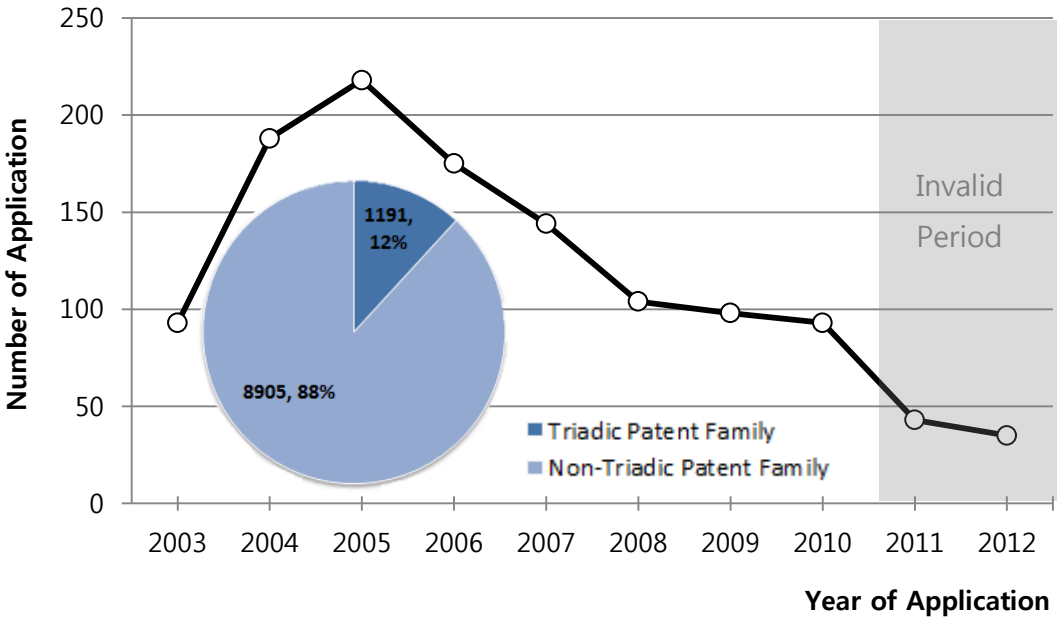


[Figure 9: Samsung's Family Status by country]

2-5. Samsung's Technology Impact Analysis

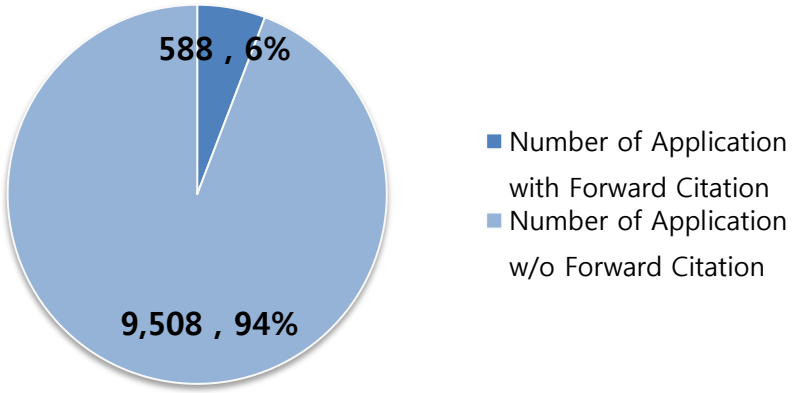
To analyze Samsung's technology impact, WIPS used Samsung's triadic patent family status and forward citation status analysis which will define the valuable patents economically and technologically.

In advance, WIPS analyzed Samsung's triadic patent family status. Samsung has 1,191 triadic patent family applications in the smart phone field. The percentage of triadic patent family applications is 12%, non-triadic patent family applications is 88%. Its number of application status provides the information that the triadic patent family curve reached the highest point in 2005, and has declined afterwards.



[Figure 10: Samsung's Triadic Patent Family Status]

In sequence, WIPS analyzed Samsung's forward citation status. Samsung has 588 applications with forward citation which accounts for 6% of total number of Samsung's applications.



[Figure 11: Samsung's Forward Citation Status]

To draw patents that are considered as valuable economically and technologically, WIPS extracted top 20% applications with forward citations and correspond to top 20% of triadic patent family applications at the same time. Samsung had 69 patents which are applicable to this condition. Therefore, we classified Samsung's essential technologies based on its extracted major technology result. The result provides that Samsung's essential technologies are transmission, wireless communication networks, and selecting technologies.

[Samsung's main technology areas]

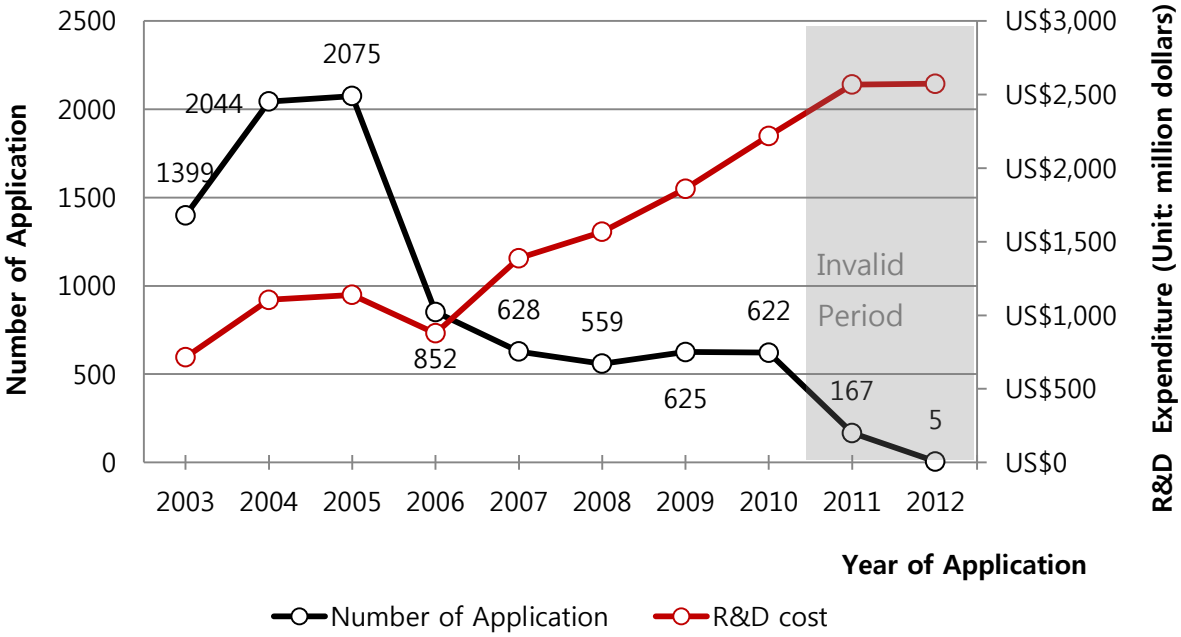
IPC	Description	No.of Appl.
H04B	Transmission	20
H04W	Wireless communication networks	11
H04Q	Selecting	11
H04J	Multiplex communication	6
H04L	Transmission of digital information	5
G06F	Electric digital data processing	2
G08C	Transmission systems for measured values, control or similar	2
H04M	Telephonic communication	1
H04K	Secret communication; jamming of communication	1

3- The analysis result of LG's Patent Portfolio

3-1.LG's Application Activity

LG's total number of smart phone patent application was 8,976 for the past ten years (2003-2013). LG's number of application curve reached highest point in 2005. In 2006, the curve has declined drastically and it maintained certain point afterwards.

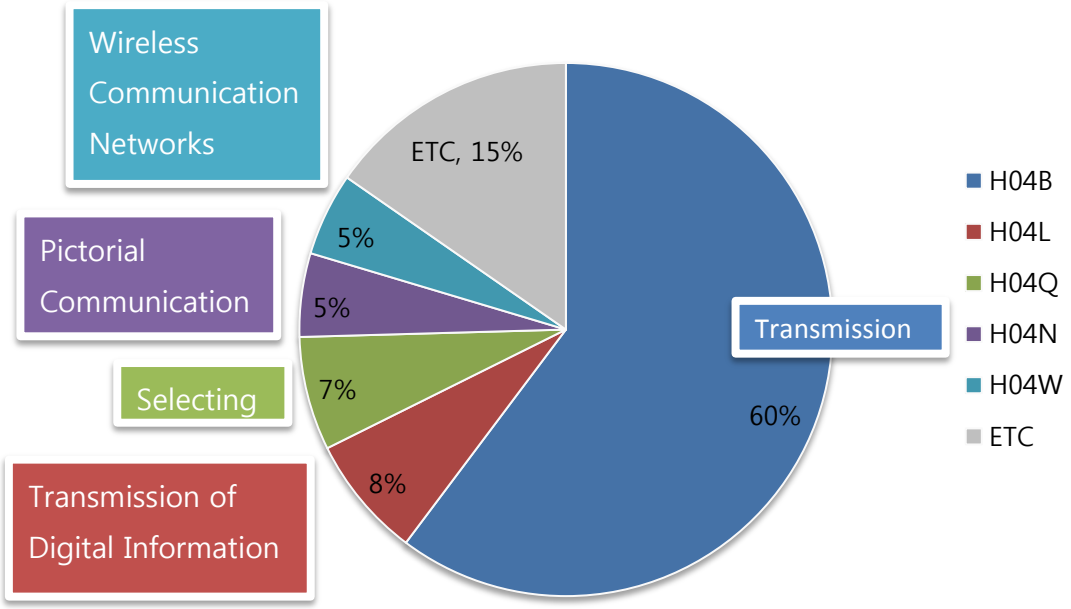
LG's R&D expenditure has slightly reduced in 2006, but it has rebounded. Although LG's R&D expenditure has been increasing, its number of application remained standstill during the last ten year period.



[Figure 12: LG's Total Application Status and R&D cost status by year]

3-2.LG's Technology Trends

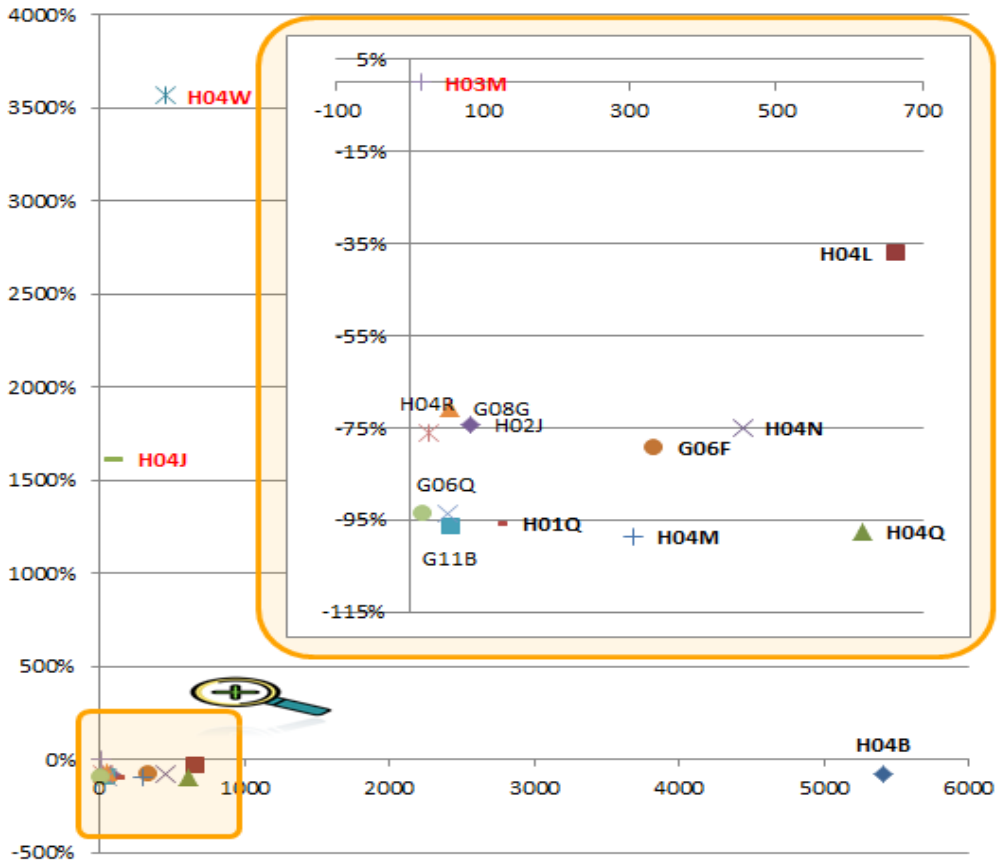
LG has been emphasizing transmission (H04B) technologies. Transmission technologies take 60% among LG's smart phone technologies based the chart (figure 13). Other technologies are relatively insignificant compared to H04B.



[Figure 13: LG's Top Smartphone Technologies during 2003-2012]

We conducted contrastive analysis to see its technological trend changes. We divided and compared the search result by 5-year period between the years 2003-2007 and 2008-2012.

Overall, the percentage of growth and the number of smartphone technologies of LG have declined during the last ten-year period. LG's technology trend chart shows that H04W (wireless communication) and H04J (multiplex communication) technologies are standing out among other technologies while others are declining. H04W technologies showed more than 3500% of growth rate and H04J technologies showed more than 1500% of growth rate. Meanwhile, the number of H04Q and H04M applications has greatly decreased and gave its places to emerging technologies such as H04W and H04J during 2008-2012.



The vertical axis: [(Number of Applications during the year 08-12-Number of Applications during the year 03-07)/Number of Applications during the year 08-12]*100

[Figure 14: LG's Technology Trends between the Years 2003 and 2012]

[LG's Top Technology Application Status]

Year 03-07			Year 08-12		
Rank	IPC	Number of Application	Rank	IPC	Number of Application
1	H04B	4489	1	H04B	919
2	H04Q	604	2	H04W	440
3	H04L	408	3	H04L	257
4	H04N	364	4	H04J	103
5	H04M	301	5	H04N	91

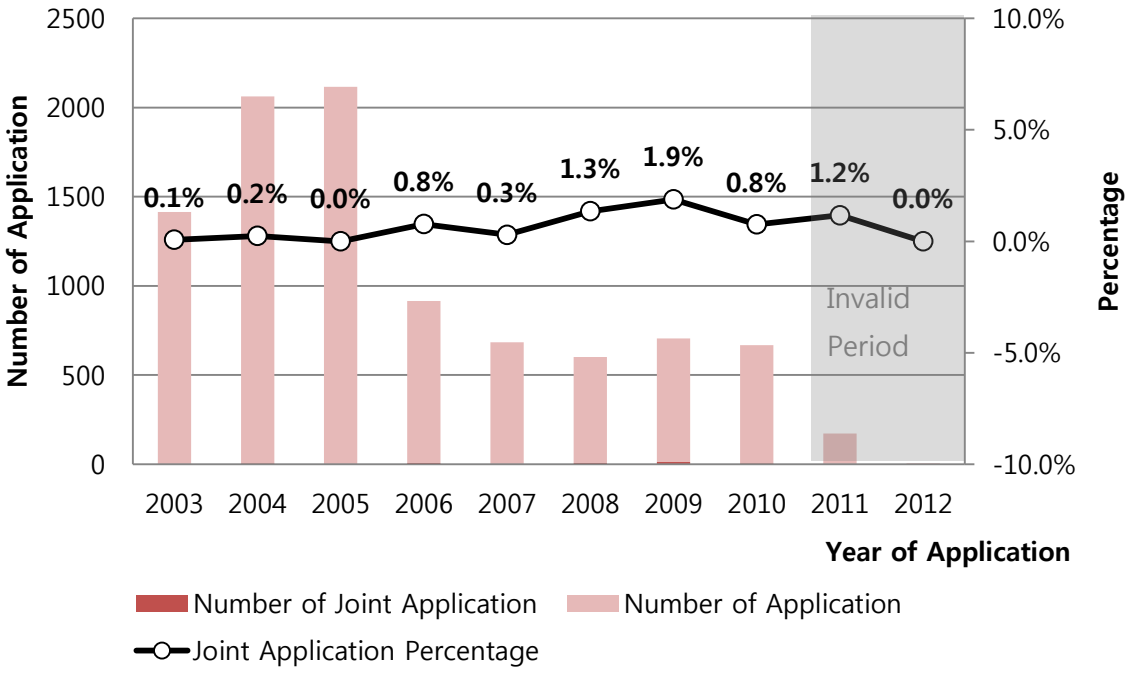
To analyze Samsung's technology in detail, WIPS analyzed most emerged technology, H04W. Within the field of LG's wireless communication technology (H04W), the main technologies during the last ten years were services making use of the location of users of terminals and messaging. Especially, its wireless resource allocation technologies have showed much larger number than other technologies in H04W field.

[LG's Main Technology Field: H04W]

IPC	Description	No.of Appl.
H04W-072/04	Wireless resource allocation	41
H04W-004/02	Services making use of the location of users or terminals	22
H04W-004/12	Messaging	20
H04W-074/08	Non-scheduled access	15
H04W-088/02	Terminal devices	15
H04W-024/10	Scheduling measurement reports	14
H04W-088/06	adopted for operation in multiple networks	13
H04W-036/08	Reselecting an access point	13
H04W-048/16	Discovering; Processing access restriction or access information	13
H04W-004/06	Selective distribution of broadcast	12
H04W-072/12	Wireless traffic scheduling	12

3-3.LG's Joint Application Status

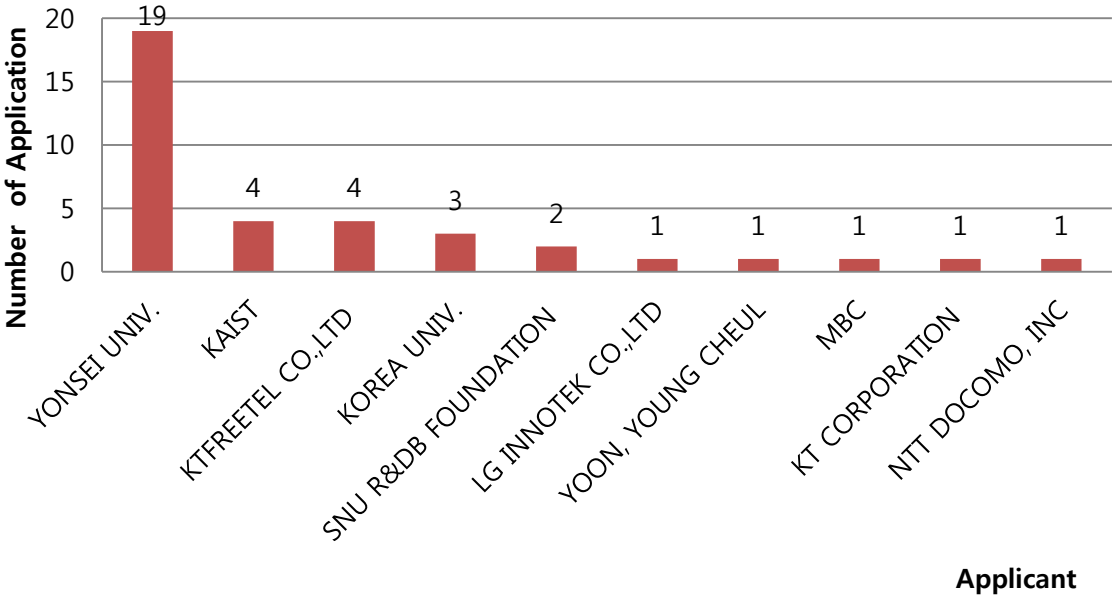
LG's percentage of joint application status during the last 10 years showed ups and downs between 0% and 2%. The numerical value or the percentage of joint application somewhat proves that LG has closed innovation strategy compare to Samsung.



[Figure 15: LG's Joint Application Status]

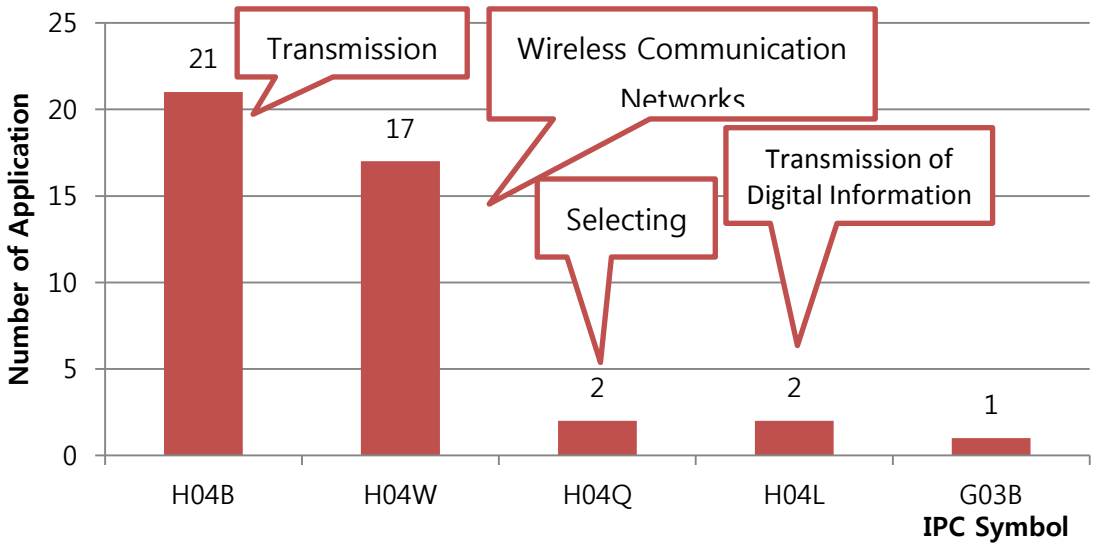
LG's major joint applicants are universities. Among those applicants, joint application activity with Yonsei University showed exceptional figure. In fact, LG promoted cooperation of academy and business with Yonsei University to promote research and development in

advanced mobile technologies in 2004.[2]



[Figure 16: LG's Top Joint Applicants]

The number of H04B technology takes the first position among other technologies and the next place is H04W by a short head. The chart proves that LG's innovation activities are mainly focused on developing major technologies.

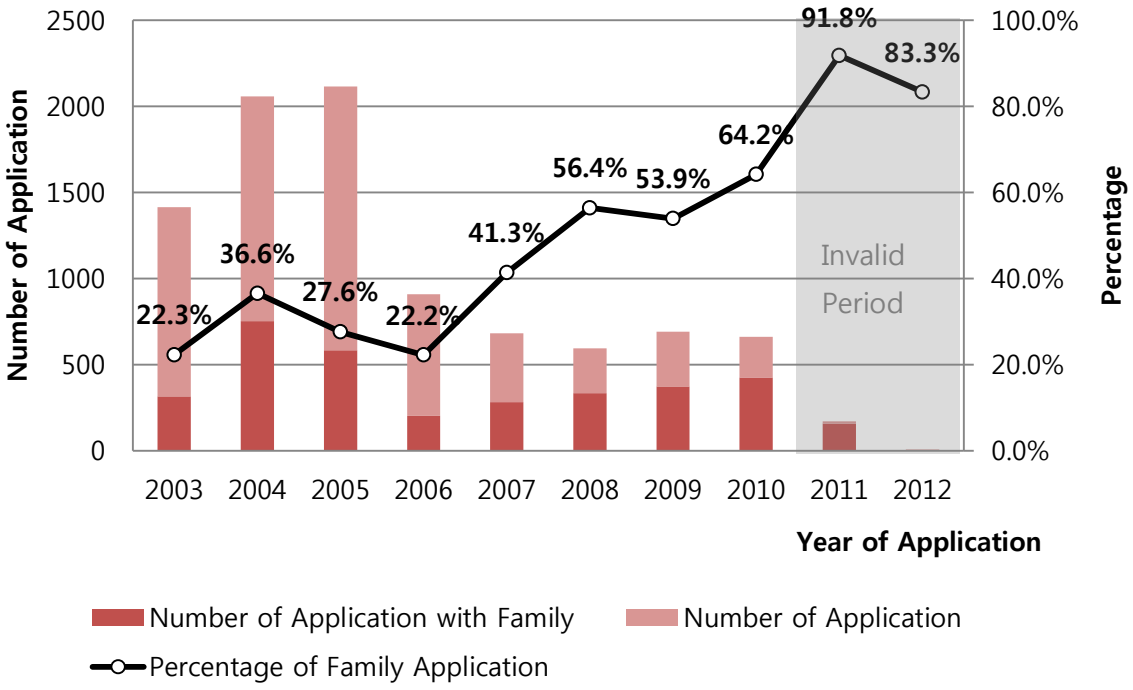


[Figure 17: LG's Top Technology areas of Joint Application]

[2] Korean Maeil Kyoungjae News
http://news.naver.com/main/read.nhn?mode=LSD&mid=sec&sid1=101&oid=009&aid=0000412828

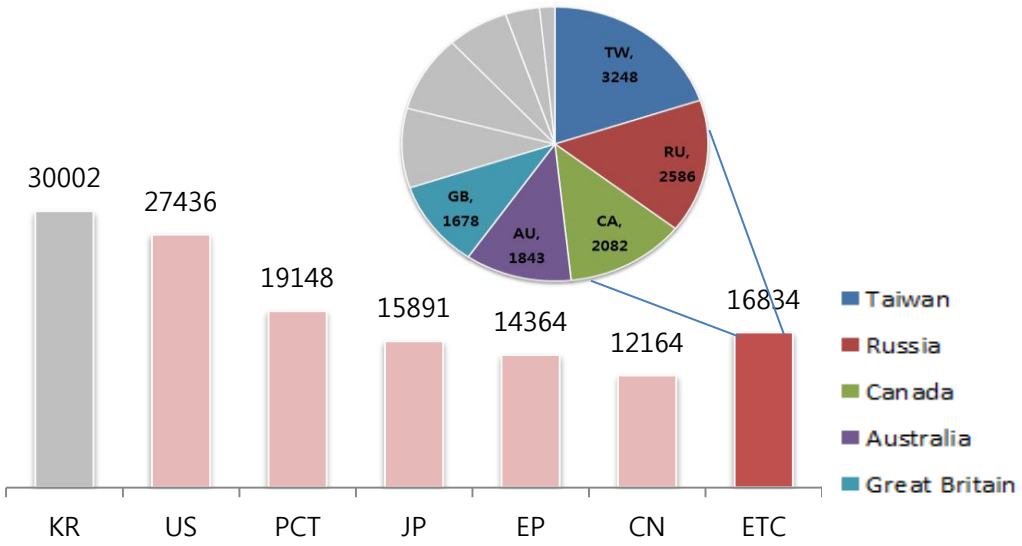
3-4.LG's Family Application Status

The family application analysis was done to figure out LG's market power globally. Even though LG's number of application has decreased during the last 10 years, the percentage of family patent has been increasing since 2006. The family application percentage figure provides the information that the company's percentage has tripled in 2010 (64.2%) compared to the year 2006 (22.2%). It can be defined that LG is intensively concentrating on global patent competitiveness.



[Figure 18: LG's Family Application Status]

WIPS also analyzed LG's family application status by country to gain information on what LG's targeting countries are. LG has great emphasis on U.S. market as much as Korean market. LG also put stress on PCT family application rather than foreign country patent offices. Besides those main offices, LG is concentrating on Asian-Pacific regions including Taiwan and Russia.

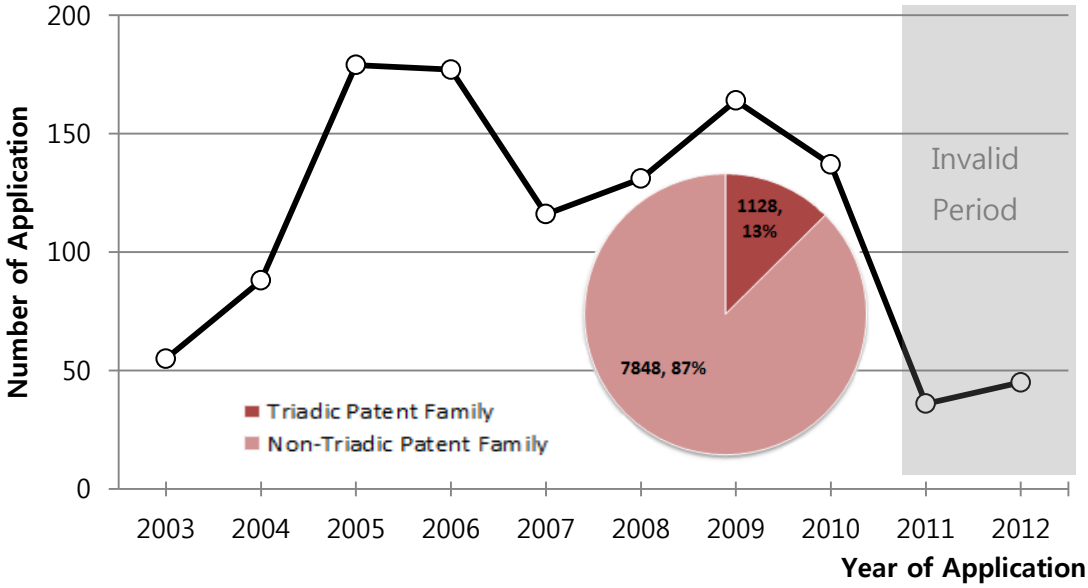


[Figure 19: LG's Family Status by country]

3-5.LG's Technology Impact Analysis

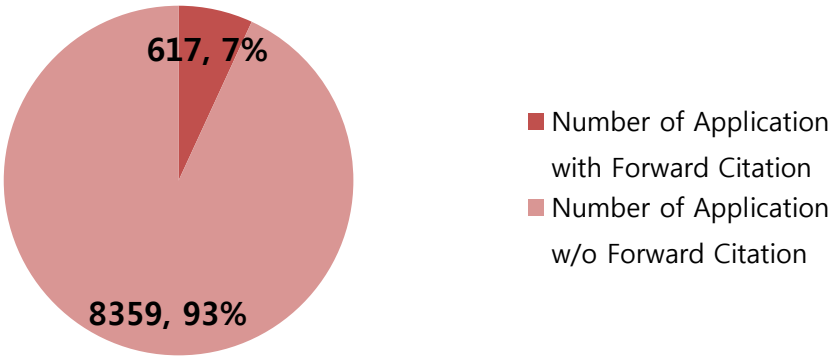
LG's triadic patent family status and forward citation status analysis has been used for getting the information on LG's technology impact.

First, LG's triadic family application status has been analyzed. LG has 1,128 triadic patent family applications in the smartphone field. The percentage of triadic patent family applications is 13%. Its number of triadic patent family application status curve showed ups and downs during the last decade.



[Figure 20: LG's Triadic Patent family status]

WIPS also analyzed LG's forward citation status. LG has 617 applications with forward citation which accounts for 7% of total number of Samsung's applications.



[Figure 21: LG's Forward Citation Status]

To derive the company's valuable patents economically and technologically, WIPS extracted the top 20% of triadic patent family applications including the top 20% of applications with forward citations to analyze LG's essential technologies. LG has 77 main patents. As a result, the analysis showed that LG concentrated on wireless communication networks, transmission of digital information and transmission technologies during the last decade based on classified essential technologies.

[LG's main technology areas]

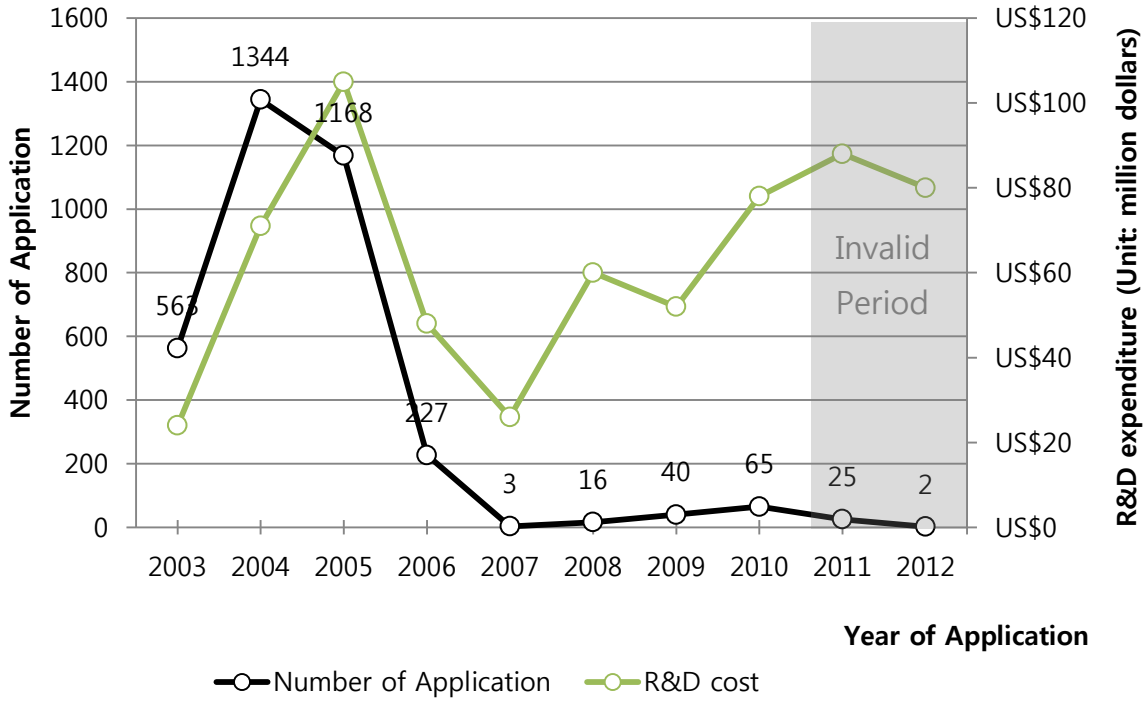
IPC	Description	No.of Appl.
H04W	Wireless communication networks	17
H04L	Transmission of digital information	14
H04B	Transmission	13
H04J	Multiplex communication	11
H04Q	Selecting	9
H04M	Telephonic communication	4
H04H	Broadcast communication	3
G06F	Electric digital data processing	3
H03M	Coding, decoding or code conversion, in general	2

4- The analysis result of Pantech's Patent Portfolio

4-1. Application Activity

The total number of Korean smartphone patent application filed by Pantech was 3,153 for the past 10 years (2003-2013). Pantech's number of application curve reached highest point in 2004. However, its total number of application has dropped drastically after 2005, and it seems almost dead in 2007. In fact, Pantech was put under a workout program worth 1.28 trillion won ($ 1.4 billion) in 2007.[3] Yet, its number of application slightly increased after it reached the lowest point in 2007 and finally finished workout program in 2012.

Pantech's R&D expenditure showed clear increasing trend until the year 2005. However, it showed a sharp decrease between the year 2005 and 2006. After the R&D expenditure curve reached the lowest point in 2007, the figure showed uptrend afterwards.

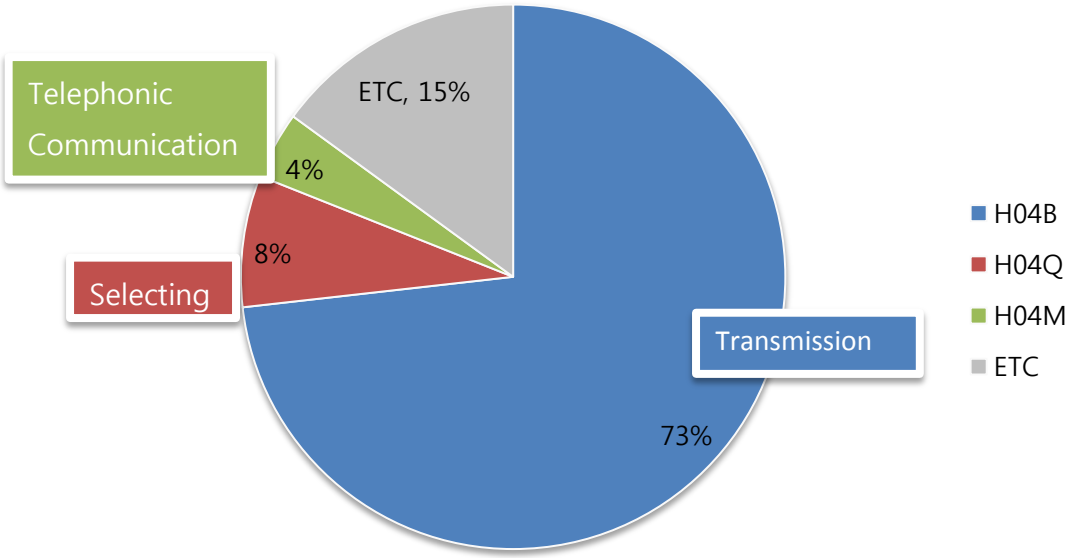


[Figure 22: Pantech's Total Application Status and R&D cost status by year]

[3] Korea Herald News Article:
http://www.koreaherald.com/view.php?ud=20111207000650

4-2. Pantech's Technology trends

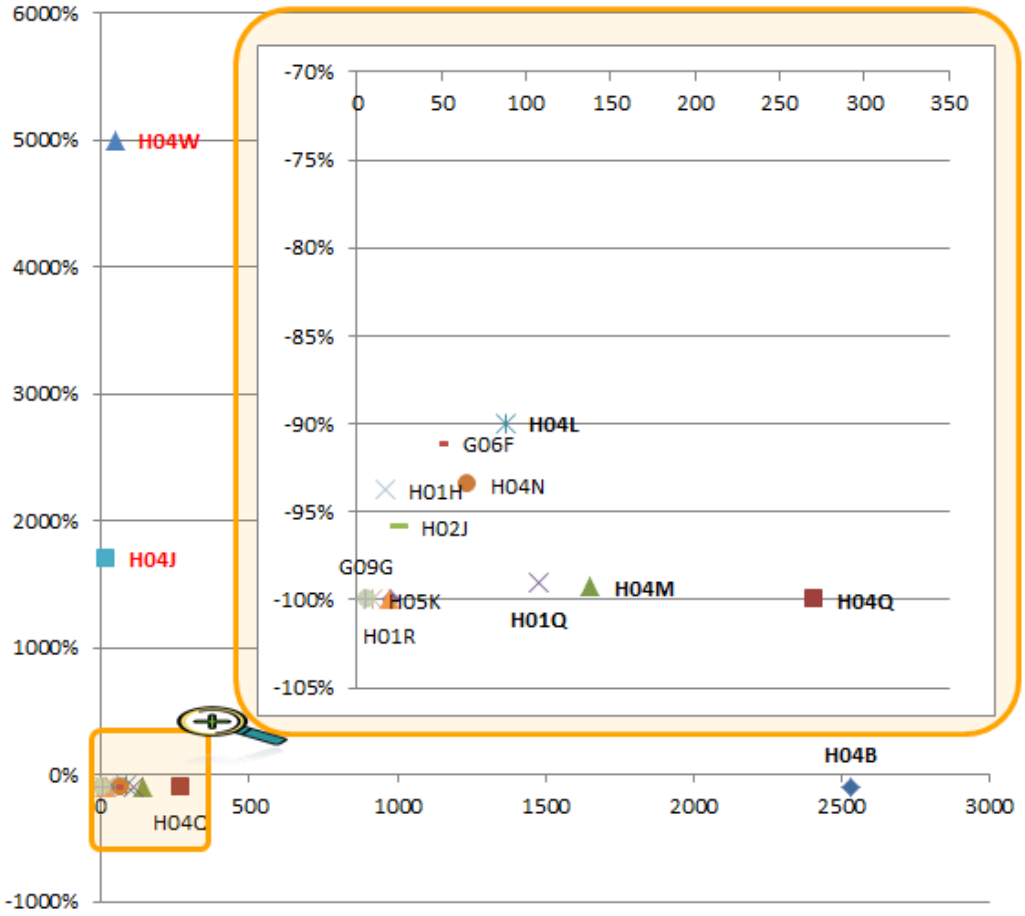
Like Samsung and LG, Pantech also has been focusing on transmission (H04B) technologies for the last decade (2003-2012). H04B technologies overwhelmingly accounted for 73% of Pantech's smartphone technologies. The percentages of other technologies are insignificant compare to H04B technologies.



[Figure 23: Pantech's Top Smartphone Technologies during the years 2003 and 2012]

We divided and compared the Pantech's smartphone patent search result by a 5-year period (2003-2007 and 2008-2012) to see its technological trend changes.

Pantech's wireless communication technologies (H04W) stand out among other top 10 technologies and showed more than 5000% of growth rate. Multiplex communication (H04J) technologies also showed more than 1500% of growth rate. In the meantime, H04M (telephonic communication) and H01Q (aerials) has excluded in the list of top applied technologies. It can be concluded that smart phone technologies have experienced a technological upheaval during the last ten year period.



The vertical axis: [(Number of Applications during the year 08-12-Number of Applications during the year 03-07)/Number of Applications during the year 08-12]*100

[Figure 24: Pantech's Technology Trends between the Years 2003 and 2012]

[Pantech's Top Technology Application Status]

Year 03-07			Year 08-12		
Rank	IPC	Number of Application	Rank	IPC	Number of Application
1	H04B	2469	1	H04B	59
2	H04Q	270	2	H04W	50
3	H04M	137	3	H04J	18
4	H01Q	106	4	H04L	8
5	H04L	80	5	H04N	4

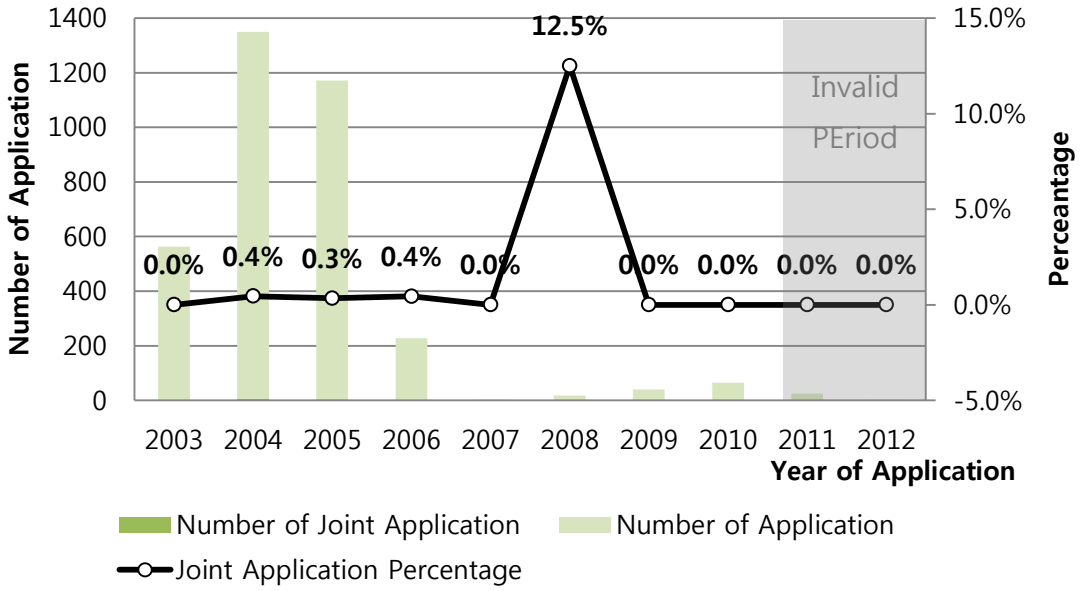
To take a look at specific technology areas, WIPS analyzed H04W technologies of Pantech. Among those wireless communication networks technologies (H04W), Wireless resource allocation technologies and synchronization arrangements technologies maintained the main technology position over the past ten years.

[Pantech's Main Technology Field: H04W]

IPC	Description	No.of Appl.
H04W-072/04	Wireless resource allocation	7
H04W-056/00	Synchronization arrangements	3
H04W-004/02	Services making use of the location of users or terminals	2
H04W-024/08	Testing using real traffic	2

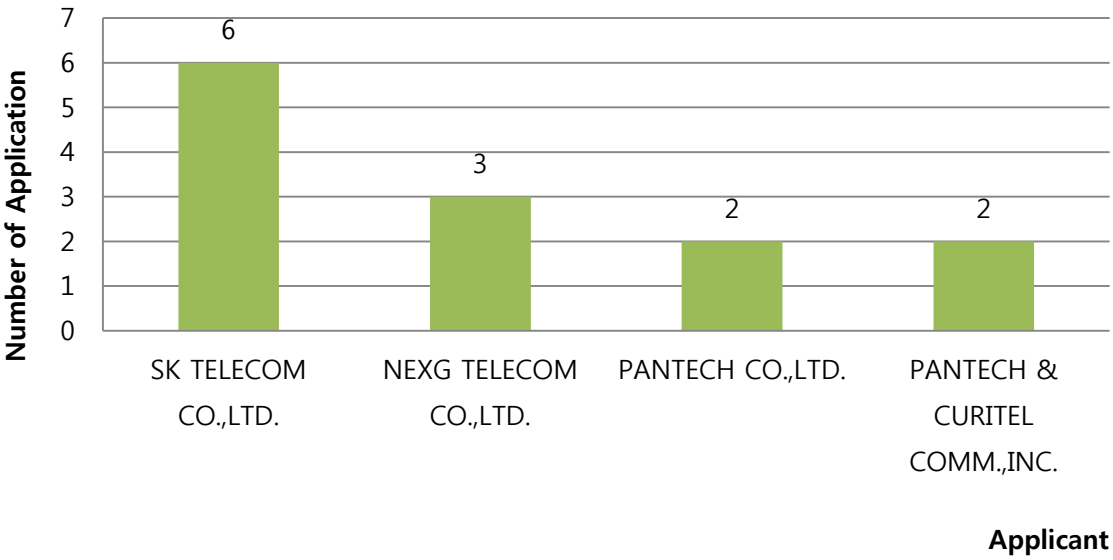
4-3. Pantech's Joint Application Status

Pantech's joint application percentage remained less than 1% until the year 2006. But, it reached highest point in 2008 (12.5%). Yet, it is an insignificant figure because Pantech's total number of application itself in 2008 was only 3.



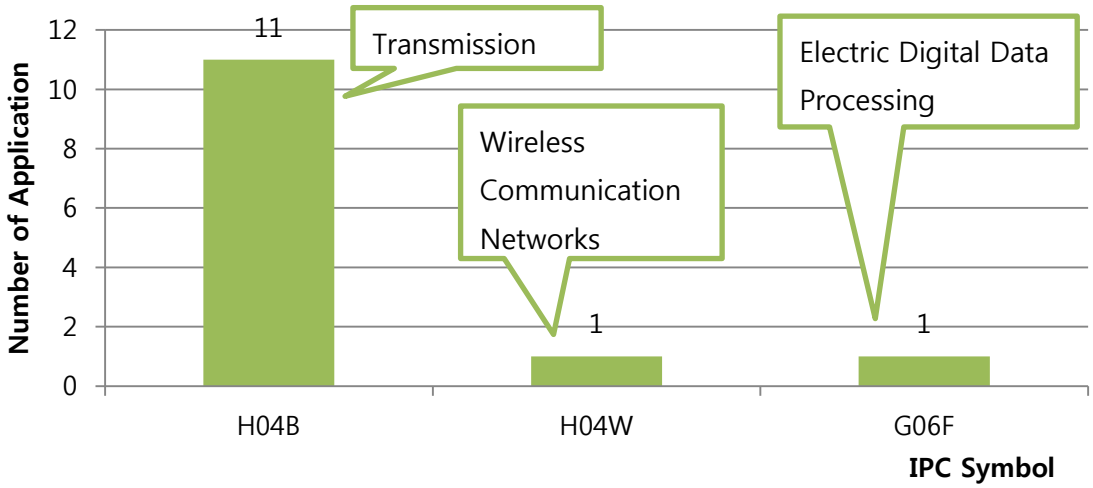
[Figure 25: Pantech's Joint Application Status]

The main joint applicants of Pantech were telecommunication companies and its affiliates. Distinctively, Pantech did not have joint application activities with universities.



[Figure 26: Pantech's Top Joint Applicants]

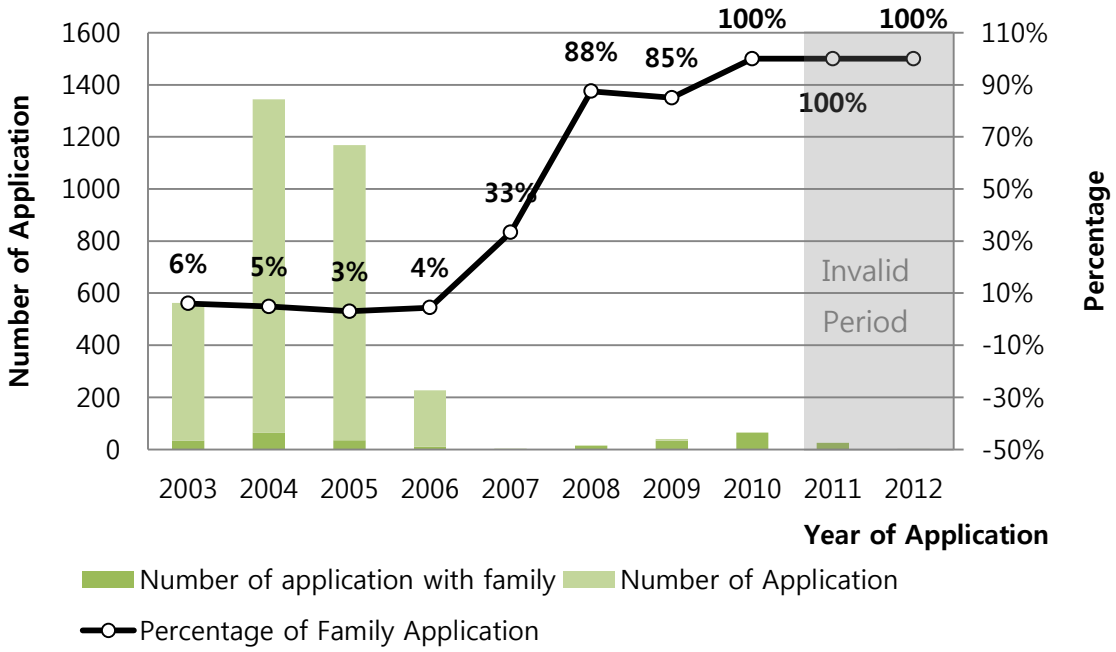
The chart provides the information that Pantech's joint application activities are mainly focused and largely based on transmission (H04B) technologies.



[Figure 27: Pantech's Top Technology areas of Joint Application]

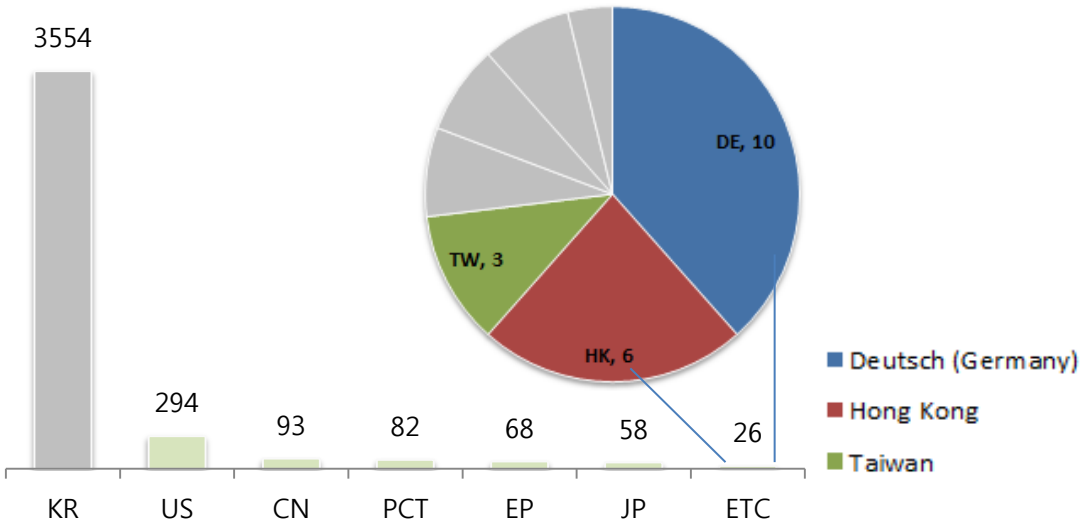
4-4. Pantech's Family Application Status

Pantech's patent family application status has been analyzed to figure out its market power. Pantech's percentage of family application remained in the ranges between 4% and 6% by 2006. The percentage suddenly rose up to 33% in 2007 and kept increasing to 100% in 2010. However, the figure after 2007 is insignificant because its absolute number of application is too few to carry out an accurate assessment of the company's competitiveness in the market.



[Figure 28: Pantech's Family Application Status]

To get the information of Pantech's targeting markets, WIPS analyzed Pantech's patent family country profile. As a result, the analysis showed that Pantech was overwhelmingly concentrated on Korean market. Except U.S., Pantech barely cared about other markets. Its market share analysis proves that Pantech is concentrating on domestic market rather than entering the world markets.

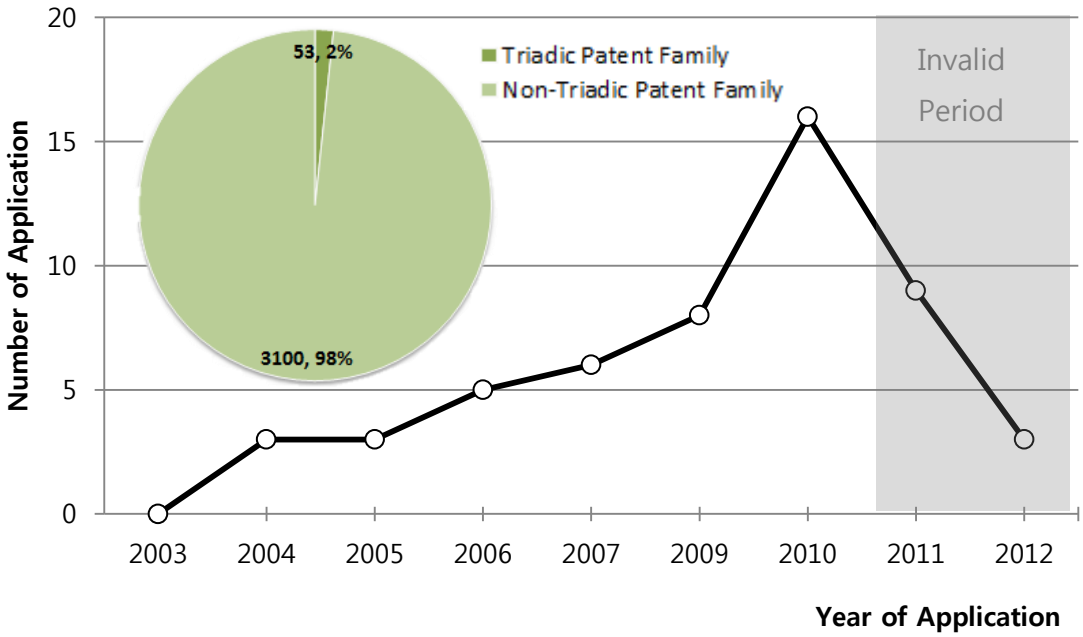


[Figure 29: Pantech's Family Status by country]

4-5. Technology Impact Analysis

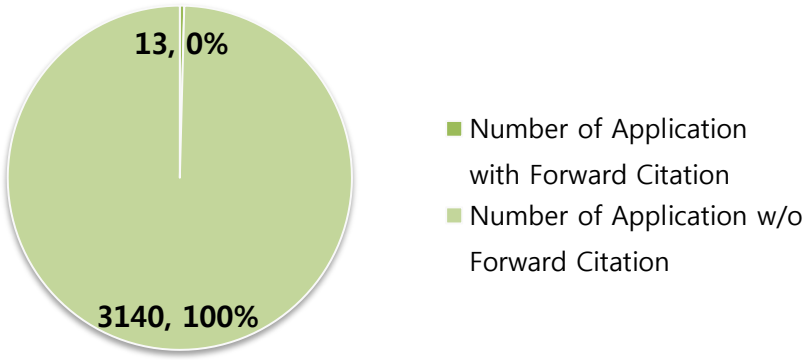
To take a look at Pantech's technology impact, the information on its triadic patent family status and forward citation status was used.

First, we analyzed Pantech's triadic patent family application status. Pantech had only 53 triadic patent family applications, and its percentage of triadic patent family applications was 2%. Although greatly outnumbered, Pantech's triadic patent family curve provided the information that Pantech is increasing its number of triadic patent family applications.



[Figure 30: Pantech's Triadic Patent Family]

Second, Pantech's forward citation status was analyzed. Pantech's forward citation status provided the information that Pantech had only 13 applications (almost 0%) with forward citation.



[Figure 31: Pantech's Forward Citation Status]

To extract Pantech's economically and technologically valuable patents, WIPS extracted patent applications of the top 20% of triadic patent family and forward citation. Pantech had only 2 essential patents which were represented by transmission technology and electrically-conductive connections technology.

[Pantech's of main technology areas]

IPC	Description	No.of Appl.
H04B	Transmission	1
H01R	Electrically-conductive connections	1

Conclusion

The report provides an insight of overall technology strategies and strategic patent reserves of Samsung, LG, and Pantech based on their patent portfolio analysis using WIPS Global, the premium online patent search engines, over the last ten years (2003-2012).

Synthetically, Samsung, LG, and Pantech's smartphone technologies have matured during the last decade. Samsung, LG and Pantech's R&D expenditure has kept on growing but their application activity has kept on decreasing. Samsung, LG and Pantech concentrated on transmission technologies (H04B) during the last decade. However, information on these three companies' technological trend changes provides that they have switched their focus on to the wireless communication technologies (H04W) followed by recent smartphone technology development.

Generally, family application status information provides entity's dominant power in the global market. Moreover, it was recognizable that Pantech was not enough to beat against both Samsung and LG. In other words, Pantech is in the level of defending small part of Korean domestic market with its domestic patent applications.

WIPS also extracted each company's essential technologies based on its extracted major patents. Since triadic patent family information provides portfolio's economic value and forward citation information provides its technological value. As a result, Samsung's essential technologies are typified by transmission, wireless communication networks, and selecting technologies and so on. LG's essential technologies are identified as wireless communication networks, transmission of digital information and transmission technologies. Pantech's essential technologies are transmission and electrically-conductive connection technologies.