

An Analysis on the Selection Process of Core Wireless Communications Technologies in Korean National IT R&D Program

Ilsue Roh¹, Byoung Nam Lee² and Jungman Lee³

¹ ETRI(Electronics and Telecommunications Research Institute), ITMRG,
161 Kajong-Dong, Yusong-Gu, Taejon, 305-600, Korea
Tel. +82-42-860-1135, Fax.: +82-42-860-6504
e-mail : isroh@etri.re.kr

² ETRI(Electronics and Telecommunications Research Institute), ITMRG,
161 Kajong-Dong, Yusong-Gu, Taejon, 305-600, Korea
Tel. +82-42-860-6636, Fax.: +82-42-860-6504

³ ETRI(Electronics and Telecommunications Research Institute), ITMRG,
161 Kajong-Dong, Yusong-Gu, Taejon, 305-600, Korea
Tel. +82-42-860-4891, Fax.: +82-42-860-6504

Abstract: This paper reviews the Korean government's selection process of core wireless communications technologies, and presents technology trends, perspectives and strategies of 5 core technologies to develop in wireless communications areas based on the mid term IT technology development plan(2002~2004). Delphi Panel Method and Analytic Hierarchy Process(AHP) Analysis were adapted to select 30 core technologies in 9 strategic areas. Especially, 5 core wireless communications technologies out of 24 required technologies are selected: 4 G Core Technology, Broadband Wireless Access Network Technology, IMT-2000 Plus STP Technology, OBP Based Multimedia Satellite Communications Technology, Stratosphere Communications System Technology. Strategic national IT R&D program has been essential to continue success story of CDMA technology, and acquiring technology independency from advanced nations. In long term perspectives, a strategy of intensive investment with prudent selection onto core technologies should be deployed in the IT R&D programs. Also, the national IT R&D programs should be limited in the high risk & high return areas where only government can afford the failures as well as better spill over effects are expected for the technology development and national economy. Korean industry has some strength in wireless communications technology area. Therefore, more policy concerns should be given into this area not only to secure present strength but also to explore better technology competitiveness.

1. Background of national R&D Program and wireless communications technologies

It is a well known fact that recent success story of Korean IT industry is a result from Korean government's prudent technology policy and smooth coordination among industries, research institutes and universities. Massive IT R&D investment and improvement of technology development environment were the main reason securing some of core and commercialization technologies. Korean government has built national R&D planning model for several years and has applied models for IT R&D programs. Especially, Korean government's main concern has been given to the national IT R&D programs to boost technology innovation and national competitiveness. "5 year plan of IT

technology development"¹, "Rolling Plan" and "Mid Term IT technology development Plan" are some examples witnessing R&D programs in Korean IT technology policy. In this study, we investigate whole process of "Mid term IT R&D plan(2002-2004)" sponsored by MIC(Ministry of Information and Communications).

Because wireless communications fields have rapidly growing, many nations have eager to preoccupy these markets as well as next generation internet based mobile multimedia market. In that reason, they have selected wireless telecommunications areas as a strategic area, and drive technology development. Including CDMA commercialization technology and handset manufacturing industry, Korea has some of leading technology and infrastructure in wireless communications technology area. Korea, also eager to keep the strength of present technology advantages and expand its technologic competitiveness in this area. Therefore, this study extensively explores wireless telecommunications area. Also, vision, strategic areas, and core technologies based on Delphi Panel Method and Analytic Hierarchy Process(AHP) Analysis will be discussed in this study.

2. The Mid term IT technology development plan in Korea

2.1 Construction of e-Korea²

Korean government's IT R&D Program started from early 1990's. The government's IT technology policies and its vision are expressed in "5 Year Plan of IT Technology Development" and "Cyber Korea 21". In "the mid term IT technology development plan in 2001", The target goals

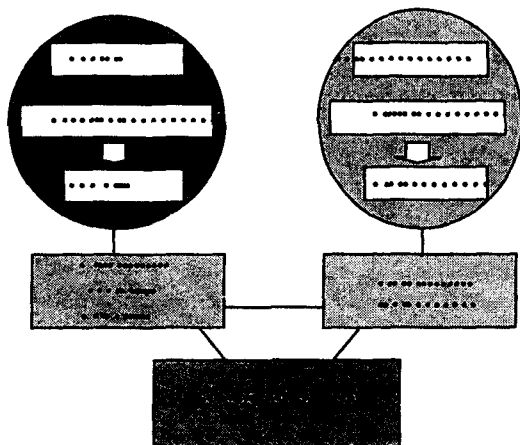
¹ This plan was launched in 1999, and the participants were MIC, IITA, ETRI and other specialist groups. Based on this plan, "5 Year Plan of IT Technology Development" in 1999, "Rolling Plan of IT Technology Development" in 2000 and "Mid-Long Term IT Technology Plan" in 2001 were established.

² Substantial part of this section was discussed in Ilsue Roh, J. Lee, and Y. Euh, "The necessity of the grand national R&D program in Korean IT industry", Proceedings of ICACT2002, 2002.2.9.

of the program are contribution of economic growth of 2% and securing 15th national competitiveness in the world.

The plan was established throughout assaying vision of technology policy, target technologies and areas, main body to execute, available resources, driving strategies, and continuance of the policy. "5 Year Plan of IT Technology Development", "Rolling Plan in 2001" and "evaluation result of technology development project in 2000" and "Top-down method" are applied in the plan. MIC is in charge of this plan and IITA, ETRI and specialist groups are participated in this plan.

Korean government's ultimate policy goal is a construction of "e-Korea" as a vision of technology development. Under this technology vision, four policy goals are established such as completion of national informatization and digitalization, development of core and fusion technologies, construction of security base for distribution, promotion of global IT industry. Working plan for these policy goals are investing available R&D resource intensively on cautiously selected 9 areas and 30 technologies. As shown in "figure 1", "Selection and Concentration" strategy is adopted in these procedures. Main areas of technology development are derived from specialist groups in connection with technology policy and technology development vision. AHP model is adopted in this process. Meanwhile, Delphi method is adopted to the target technologies for the establishment of priority setting.



"Figure 1. The procedures of deriving main areas and target technologies."

Source : ETRI, " Mid-long term plan of IT technology development ", ITMRG(inside edition), 2001.4.

9 areas consist of 5 main areas and 2 strategic areas and 2 infrastructure areas. 30 target technologies are derived from 9 areas. 5 main areas are selected to enhance general competitiveness throughout the development of core technologies. 2 strategic areas are selected to secure

domestic market throughout the development of applied technologies. 2 infrastructure areas are selected to boost localization ratio and technology independency from advanced nations throughout the development of basic research laboratory technologies.

Korean IT industry has made consensus to select 30 target technologies in 9 areas to reduce its technology gap with other advanced nations, and to promote IT industry through buildup of technology competitiveness. 9 technology development areas are selected on the basis of "Selection and Concentration strategy", and the details are summarized in "Table 1".

"Table 1. The Areas of Selected Technology Development."

Areas	The Goals of Technology Development in 9 Areas
Optical Internet	As a core national infrastructure for 21 century, providing optimal solution to deal with various situations due to increasing IT traffic
Mobile Communications	To meet the Necessity of increasing exchange of various information resulted from trend of personalization and internationalization
Digital Broadcasting	Building up of Substructure of knowledge-information society by means of establishing an information infrastructure through merging technology among broadcasting, information and telecommunication, and internet
S/W, Contents	Unified solution for various technologies such as information storage, sharing, creation of services
Computer	As a leader of multimedia due to the increase of internet user, acquiring domestic market base and create export industry
2 Strategic Areas	Acquiring stable domestic market throughout applied technology development
Information Appliance	A tool reducing digital divide and improving IT life without limit of anytime and anywhere
Information Security	Securing reliability of e-trade and stable information services and controlling negative effects of informatization
2 Infrastructure Areas	Diminishing foreign technology dependency and improving localization ratio throughout securing basic research laboratory technology
Basic Research laboratory	Overcoming technology dependency from advanced nations through developing new technology and drastic improvement of existing technologies, and securing leading technology and technological competitiveness
Core Components	Increasing export of IT components and localization ratio throughout smooth provision of improved core components for various systems and terminals

Source : I summarized this table from ETRI, " Mid-long term plan of IT technology development ", ITMRG(inside edition), 2001.4.

In this plan, we can see the future goal of wireless communications area. Major manufacturers are began to research 4G technology, and Japan is the most aggressive investor in 4G technology development. In general, expected goals of technological effects are to accomplish 80 % of localization ratio in part industry. Expected goals of economic effects are creation of 480 trillion Won worth of new production and creation of 220,000 new jobs. Social goal is to arrive in advanced nation or OECD level informatization society to achieve a drastic increase of public well-being.

2.2 Core technologies in wireless communications area

As shown in "table 2", we divide wireless communications technology area into 4 sub-areas such as mobile communications technology, satellite communications technology, radio resource technology, and stratosphere communications technology. And then, we listed 24 required technologies and finally selected 5 core technologies in 4 sub-areas.

"Table 2. 4 sub-area of wireless communications area."

Wireless Communications Area	Mobile communications technology
	Satellite communications technology
	Radio resource technology
	Stratosphere communications technology

4 G Core Technology, Broadband Wireless Access Network Technology, IMT-2000 Plus STP Technology, OBP Based Multimedia Satellite Communications Technology, Stratosphere Communications System Technology are selected as a core technology in this field. 5 core technologies and technology development strategies of Wireless Communication field are described in "Table 3".

"Table 3. The Strategies of Core Technology Development in Wireless Communications area."

Core Technology	Strategies of Technology Development
4G Core Technology	<ul style="list-style-type: none"> - Concentration of research resource and collaboration of international technology trend - Preparatory research of major core technology in synchronous/asynchronous type - Yearly base research by rolling plan - Signing MoU for Cooperation among industry/ research institution/ university
Broadband Wireless Access Network Technology	<ul style="list-style-type: none"> - Construction of specialists human network for network technology - Construction of Test Bed - Guiding international standard by integration of domestic network
IMT-2000 Plus STP Technology	<ul style="list-style-type: none"> - Developing system and technology based on international standard - Cooperation between manufacturers/ research institution to induce many

	participants - Encourage participation of various venture firms and mid-small enterprises from technology development stage
OBP Based Multimedia Satellite Communications Technology	<ul style="list-style-type: none"> - Construction of Test Bed for ultra high speed internet service and provision of fixed/mobile interactive multimedia service - Developing integrated linkage/ service technology from integrating various networks and services - Standardize ITU-R standard
Stratosphere Communications System Technology	<ul style="list-style-type: none"> - Strategic alliance with foreign industry and research institution - Utilization of accumulated satellite communications technology

Source : I summarized this table from ETRI, " Mid-long term plan of IT technology development ", ITMRG(inside edition), 2001.4.

Global technology trends and market trends of 5 technologies are extensively investigated and the details are described in "Table 4". Korea's general technology gaps against advanced nations range from 1 to 3 years, but no gaps are seen in some technologies, and Korea has opportunity to gain technology competitiveness in some areas where research is at the beginning stage in time.

"Table 4. The market and technology trend of core wireless telecommunication area."

Core technologies of wireless communications area		
4G Core Technology		
Country	Technology Trend	Market Trend
World	<ul style="list-style-type: none"> - Major manufacturers are began to research 4G technology - Japan is the most aggressive investor in 4G technology development 	- None
Korea	- None	- None
IMT-2000 Plus STP Technology		
World	<ul style="list-style-type: none"> - Evolving toward IP based network structure - Provide IP based multimedia service 	<ul style="list-style-type: none"> - Preparation of early stage of IMT-2000 system - Install in 2005 in Japan
Korea	<ul style="list-style-type: none"> - Focused on international standardization activity 	- Preparation of IMT-2000 system
Stratosphere Communications System Technology		
World	<ul style="list-style-type: none"> - Japan: state initiative - U.S. : industry initiative - Europe : preparation of research 	<ul style="list-style-type: none"> - Higher marketability and big spillover effects are expected if researches are successful
Korea	<ul style="list-style-type: none"> - Infrastructure and standardization research 	<ul style="list-style-type: none"> - Higher marketability and Big spillover effect onto other industry - Useful for telecommunications infrastructure if researches are succeeded

OBP Based Multimedia Satellite Communications Technology		
World	<ul style="list-style-type: none"> - U.S. : Hooping spot beam, built test-bed for on-board switching technology - Japan: CRL experimental Gigabit Satellite in 2005 	<ul style="list-style-type: none"> - Expected market of world satellite internet : \$157 mil. in 2002 - Expected broadband multimedia service: \$15 billion - Personal mobile satellite multimedia handset: \$ 1.5 billion
Korea	<ul style="list-style-type: none"> - Low technology level of Satellite B-ISDN /ATM 	<ul style="list-style-type: none"> - Expected broadband multimedia service: \$157 mil. - Repeater: 4% increase per year
Integrated Broadband Wireless Access Network Technology		
World	<ul style="list-style-type: none"> - Developing 802.11a 5GHz wireless LAN equipment - Low technology level of HIPERLAN/2 5GHz wireless LAN equipment, and wireless MAN technology - Research on Broadband(0.8~5GHz z) RF transceiver 	<ul style="list-style-type: none"> - Integrated wireless access service launched in mid 2000 - UWBM wireless access service market will be open in mid 2000' - Expanding Commercial service market of DSRC system
Korea	<ul style="list-style-type: none"> - Completion of 5GHz wireless LAN(IEEE 802.11a) - Researching B-WLL technology 	<ul style="list-style-type: none"> - Early stage of broadband wireless internet service market based on 5GHz wireless LAN technology based - Forming commercial service market of DSRC system

Source : I summarized this table from ETRI, " Mid-long term plan of IT technology development ", ITMRG(inside edition), 2001.4.

3. Conclusion

Massive investment over 20 year, Korea has world class IT infrastructure and strong national competitiveness in the world. Massive IT R&D investment was not reduced even in the era of IMF. This continuous IT technology policy was one of the main reasons to overcome such hardship and became an economic locomotive to boost the economy. Although, Korean economy has enjoyed successful technology development accomplishment of DRAM and mobile communications technology for several years, it is a right time to find another million seller items. That is why we have to discuss national IT R&D programs again. The government, private companies, and research institutions should maintain close relation for the successful implementation of national IT R&D programs.

As we see in this paper, the government selected 9 strategic areas and 30 core technologies in 2001. In case of wireless communications technology area, 5 core technologies are selected such as 4 G core technology, IMT-2000 plus STP technology, Stratosphere

communications system technology, OBP based multimedia satellite communications technology, and Integrated broadband wireless access network technology. Various strategies will be deployed such as construction of human network, concentration of research resource and collaboration of foreign industry and research institution and active participation of international standardization activity.

Selection process of core technologies has been carried out by consensus basis among interest groups. However, technology development areas and core technologies should be decided based on "selection and concentration strategy" to improve coreness and basis of technological capability. To maximize spill over effects of technology development, limited available research resources such as research personals and budgets should be put onto right place with right time based on priority factors such as marketability, economy and urgency. Moreover, national IT R&D programs should have clear goals, results and priority settings. Main direction of grand national R&D programs should be limited to the areas and technologies which promotes IT related industries, or improves technology competitiveness, or national level research programs that private sector can not afford failures. Also, the priority should be given to the areas where bigger spill over effects are expected to the economy³.

Above all, wireless technology area has rapidly growing market and Korea has some strength in this area. And securing core technology capability in wireless communications technology area is one way to acquire national competitiveness. Therefore more policy concern and R&D resources should be given to those technology development areas and wireless communications area in particular.

REFERENCES

- [1] ETRI, " The trend of IT technology and industry 2001", ITMRI, (Inside edition)2001.4.
- [2] ----, " Big national R&D Project Plan", ITMRI(Inside edition), 2001.4.
- [3] ----, " IT Korea 2005", ITMRI(Inside edition), 2001.5.
- [4] ----, "Mid-long term IT technology development plan", ITMRI(Inside edition), 2001.5.
- [5] Ilsue Roh, J. Lee, and Y. Euh, "The necessity of the grand national R&D program in Korean IT industry", Proceedings of ICACT2002, 2002.2.9.
- [6] NSF, " Information Technology for the Twenty-First Century: A Bold Investment in America's Future", 1999.
- [7] ----, "Backgrounder : NSF Information Technology for the 21st Century", 2000.
- [8] PITAC, 1999 Information Technology Research: Investing in our Future.
- [9] www.mic.go.kr

³ Substantial part of this section was discussed in Ilsue Roh, J. Lee, and Y. Euh, "The necessity of the grand national R&D program in Korean IT industry", Proceedings of ICACT2002, 2002.2.9.